STACK
ANNEX

5
022
170

UC SOUTHERN REGIONAL LIBRARY FACILITY
A 000 090 830 1

NOTES ON THE PRACTICAL
DUTIES OF
SHIPMASTERS

NET BOOK.—This book is supplied to the Trade on terms which will not allow of Discount to the Public.

CHARLES GRIFFIN & CO., LTD.

3/-

NOTES ON THE PRACTICAL DUTIES OF
SHIPMASTERS

GRIFFIN'S NAUTICAL SERIES.

The British Mercantile Marine: An Historical Sketch of its Rise and Development. By Capt. Blackmore. 3s. 6d.

"Captain Blackmore's splendid book . . . contains paragraphs on every point of interest to the Merchant Marine. The 243 pages of this book are the most valuable to the sea captain that have ever been compiled."—*Merchant Service Review.*

Elementary Seamanship. By D. Wilson-Barker, Master Mariner, F.R.S.E., F.R.G.S. Fifth Edition, Thoroughly Revised, pp. i–xvi + 250. With Frontispiece, 24 Plates (3 Coloured) and 63 Illustrations in the text. 6s.

"This admirable manual, by Capt. Wilson-Barker, of the *Worcester*, seems to us perfectly designed."—*Athenæum.*

Know Your Own Ship: A Simple Explanation of the Stability, Construction, Tonnage, and Freeboard of Ships. By Thos. Walton, Naval Architect. With numerous Illustrations. Eleventh Edition, Revised. 7s. 6d.

Mr. Walton's book will be found very useful."—*The Engineer.*

Navigation: Theoretical and Practical. By D. Wilson-Barker, Master Mariner, &c., and William Allingham. Second Edition, pp. i–xii + 156, 3s. 6d.

"Precisely the kind of work required for the New Certificates of competency. Candidates will find it invaluable."—*Dundee Advertiser.*

Marine Meteorology: For Officers of the Merchant Navy. By William Allingham, First Class Honours, Navigation, Science and Art Department. With Illustrations, Maps, and Diagrams, and *facsimile* reproduction of log page. 7s. 6d.

"Quite the best publication on this subject."—*Shipping Gazette.*

Latitude and Longitude: How to find them. By W. J. Millar, C.E. Second Edition, Revised. 2s.

"Cannot but prove an acquisition to those studying navigation."—*Marine Engineer.*

Practical Mechanics: Applied to the Requirements of the Sailor. By Thos. Mackenzie, Master Mariner, F.R.A.S. Third Edition, Revised. 3s. 6d.

"Well worth the money . . . exceedingly helpful."—*Shipping World.*

Trigonometry: For the Young Sailor, &c. By Rich. C. Buck, of the Thames Nautical Training College, H.M.S. *Worcester.* Third Edition, Revised. 3s. 6d.

"This eminently practical and reliable volume."—*Schoolmaster.*

Practical Algebra. By Rich. C. Buck. Companion Volume to the above for sailors and others. Second Edition. 3s. 6d.

"It is just the book for the young sailor mindful of progress."—*Nautical Magazine.*

The Legal Duties of Shipmasters. By Benedict Wm. Ginsburg, M.A., LL.D., of the Inner Temple and Northern Circuit; Barrister-at-Law. Third Edition, Thoroughly Revised and brought up to date.

"Invaluable to masters. . . . We can fully recommend it."—*Shipping Gazette.*

A Medical and Surgical Help for Shipmasters. Including First Aid at Sea. By Wm. Johnson Smith, F.R.C.S., Principal Medical Officer, Seaman's Hospital, Greenwich. Third Edition, Revised. 6s.

"Sound, judicious, really helpful."—*The Lancet.*

London: CHARLES GRIFFIN & CO. Ltd., Exeter Street, Strand.

NOTES ON THE PRACTICAL DUTIES OF

SHIPMASTERS

BY

CAPTAIN W. HARRY WILKES
LIEUT. R.N.R.
EXTRA MASTER, F.R. MET. SOC., YOUNGER
BROTHER OF THE TRINITY HOUSE

WITH ILLUSTRATIONS

LONDON
CHARLES GRIFFIN AND COMPANY LIMITED
EXETER STREET, STRAND
1911

All Rights Reserved

PREFACE

The School of Experience is a good school, but to a Shipmaster may be very costly and even disastrous, and in any case unnecessarily slow.

The duties of Shipmasters are at the present day of so diverse a nature that no Shipmaster can afford to neglect any opportunity of becoming thoroughly conversant with the usages of the trades in which he may from time to time become engaged.

These notes have been selected from numerous jottings made when engaged as a Shipmaster in a variety of trades in all parts of the world. They relate to practical duties rather than to legal duties, since valuable books written by many of the greatest authorities upon the laws of sea-carriage are usually to be found in the libraries of most Shipmasters.

A Shipmaster is frequently confronted with difficulties, and in the early stages of his career

973771

such notes as are set forth in this book should be of service to him in making plain many points which otherwise might be perplexing.

A glance through the Table of Contents will indicate the direction in which the book can assist, and the author hopes it may save others from difficulties he has experienced.

W. HARRY WILKES

May 1911

TABLE OF CONTENTS

PAGE

Upon First Taking Command of a Vessel 1

Papers the Master Requires when Entering at the Custom House in a Home Port 4

Bills of Health 7

Noting Protest 11

Master's Duty to his Owners, Agents, etc. 12

Master's Treatment of Port Officials 14

Pilots 16

Showing of Colours, and Quarantine Flag 17

Surveys Required when Discharging and Loading 18

A Method of Computing a Vessel's Draft by Means of which the Trim can be Accurately Calculated during the Course of a Long Voyage, when Loading in an Open Roadstead, or before Taking in a Quantity of Weight and Filling up with Measurement Cargo, with Illustrations 21

Various Formulæ 30

Loading a Steamer with a Homogeneous Cargo and Hints upon Filling and Emptying Ballast-Tanks 33

Dunnage 37

Entries Required in Ship's Log 39

PAGE

PAPERS REQUIRED BY THE MASTER WHEN CLEARING FROM A HOME PORT 40

PAPERS REQUIRED BY THE MASTER WHEN ENTERING AT AND CLEARING FROM A FOREIGN PORT 41

THE IMPORTANCE OF SOUNDING BALLAST-TANKS AND BILGES 43

BILLS OF LADING, REMITTING FREIGHT HOME AND LETTERS OF INDEMNITY 46

CHARTER-PARTIES, INCLUDING LAY-DAYS AND DEMURRAGE 54

PARTICULAR AVERAGE 66

GENERAL AVERAGE AND EXTENDING PROTEST 67

HOW AN AVERAGE IS "STRUCK" 72

AVERAGE BOND 74

SPECIFICATIONS FOR REPAIRS, AND SURVEYS REQUIRED AFTER DAMAGE TO VESSEL 75

SUEZ CANAL TONNAGE 80

CARRIAGE AND STOWAGE OF DIFFERENT CARGOES 82

GRAPHIC METHOD OF FINDING THE STRAINS UPON DERRICKS AND SPARS WHEN LIFTING WEIGHTS, WITH ILLUSTRATIONS 99

METHOD OF RIGGING A HEAVY LIFT DERRICK AND HOW TO FIND THE STRAINS SET UP ON SAME, WITH ILLUSTRATION 107

STRAINS UPON TACKLES, WITH ILLUSTRATION 113

INDEX 117

THE SHIPMASTER'S DUTIES

UPON FIRST TAKING COMMAND OF A VESSEL

Upon being appointed to the command of a vessel the master should immediately proceed on board, and should the crew be on her in a home port, or the vessel be in a foreign port, he will see that the retiring master hands over the following documents to him:

Register.
Load-Line Certificate.
Last Light Bill.
Articles.
Official Log-Book.
List of Bonded Stores. (Inspect seals to see that they are intact.)
Suez Canal Certificate.
Classification Certificate.
Anchors and Chains Certificate.
Boiler Certificate.
Boats and Lights Certificate (if on board).

An entry to the effect that the preceding papers have been handed over should have been made in the official log-book, and another entry in the same book should be made by the relieving master that the papers enumerated in in the preceding entry have been received by him.

In addition to the preceding papers a list of the following papers and articles should have been made out by the retiring master in triplicate, the relieving master, after satisfying himself that the list is correct, will sign them all, retaining one for himself. Should the retiring master not have made any list out, then it is the relieving master's duty to have a list prepared as follows in case of disputes afterwards:

Stores on Board of every Description.
Catalogue of Charts (always work with Admiralty charts).
Compass Observation Book.
Navigation Instruments.
Sailing Directions.
Copy of Protest (if it has been noted)
Copy of Charter-Party.
Wages Accounts.

The relieving master should now get a letter from the owner to the collector of customs ; or if in a foreign port from the ship's agent to the British consul, asking him to enter the relieving master's name on the ship's register : the master's certificate will be required for this purpose.

After having his name put upon the register, if in a home port the master will then go to the shipping office and get his name put on the ship's articles as master.

It is possible that the articles will be at the shipping office when the master takes over the command, in which case it is easy to satisfy himself that this document is deposited in the proper quarter before he makes the entry in the official log-book.

If in a foreign port the register and articles will probably be in the hands of the British consul.

Care should always be taken that when the papers are handed over to the master that he examines them carefully to see whether he has been given the register and articles belonging to his own vessel, as in many instances another ship's papers have been put into the ship's satchel by the consular clerks. If this precaution is not taken the master may only find out the mistake upon proceeding to sea.

Ship's Papers a Master requires at a Home Port

Pratique. After being boarded by the port medical officer, should the crew be found all well and there has been no contagious disease on board since leaving the last port, and after examining the bill of health and finding it correct, the medical officer will give the master a *Pratique Paper,* which permits him to take the vessel into her berth. This paper will be required at the Custom House when entering inwards.

Manifest of Dutiable Ship's Stores. This must be made out before arrival and handed to the Custom House boarding officer, who will inspect the stores to see if the manifest is correct. A copy must be left with the customs officer, and another taken to the Custom House when entering inwards.

In a home port a list will be required of dutiable goods in the crew's possession, and every member will be required to sign his name for the amount he renders.

In a foreign port it is as well to make out the manifest of stores in triplicate, and to retain a copy on board the ship.

When entering inwards at the Custom House the master will require the following documents:

- *Clearance from the last Port*, or if the ship has loaded at more than one port, *the clearance from each port.*
- *Bills of Health from each Port touched at from the time he first took Cargo on Board.*
- *Last Light Bill.*
- *Pratique Paper.*
- *Manifest of Ship's Stores.*
- *Register*, which should have the *Load-Line Certificate* attached, also the *Last Light Bill*, for convenience.
- *Manifest of Cargo.*

The Register with its attached Light Bill and Load-Line Certificate will be handed back to him.

At the shipping office he must hand in the following papers: *Crew's Articles of Agreement* and the *Official Log-Book.*

While at the shipping office he should arrange a time with the superintendent for paying off his crew.

Paying off Crew. The crew must be paid off before the superintendent of the Mercantile Marine within forty-eight hours of the ship's arrival at the terminal port in the United Kingdom, or if arriving late on Saturday night or Sunday morning, then they must be paid off not later than the following Tuesday during office hours.

The crew must be given their accounts of wages twenty-four hours before paying them off, if the full forty-eight hours' delay is incurred; but should the crew be paid off on the day following the ship's arrival in the terminal port, then the accounts of wages may be given them when and where convenient.

After paying off the crew the superintendent will hand the master the B.B. form, which certifies that the master has complied with the regulations and has paid off his crew.

This B.B. form will be required by the

superintendent before he will open articles of agreement with a new crew.

Signing on New Crew. After signing on a new crew the superintendent will hand the master the A.A. form, which certifies that the master has complied with the law when signing on his crew and that his crew is complete; the *Articles of Agreement, Official Log-Book, Accounts of Wages Forms,* and the *Latest Advices to Mariners* will then be handed to him.

Jerque Note. When the ship is discharged the Custom House officer will, after seeing that all the cargo is out, and the seals on the bonded stores are intact, give the master a *Jerque Note,* which will be required at the Custom House when clearing outward.

Should a part of the cargo only be delivered at that port and the ship has cargo for other ports in the United Kingdom, the Custom House officer gives the master a *Travelling Bill.* Frequently this is sent to the next port by post.

Bills of Health. It is important that the master should have a bill of health from the consulate of the country for which his vessel has been cleared at the Custom House.

Should the vessel have to call at any port on the way to her port of destination for bunker coals, it is not always necessary to clear for that port; therefore it will not be necessary for the master to obtain a bill of health from the consulate of the country to which the coaling station belongs. If the master has cleared for that coaling station then he must obtain a bill of health. In the writer's experience the Port Authorities at the coaling stations on the way will not put any difficulties in the way of vessels that call there without having cleared for that port; on the contrary, they will welcome them, for it all means business, and in these days of strong competition they dare not bring their coaling port into disrepute. Therefore it is a saving of expense to clear for the port to which the vessel is bound for cargo purposes, and put into any intermediate ports in distress. Obtain a bill of health from the Port Authorities of the coaling port, and another from the consulate of the country to which your vessel is bound, before leaving.

It frequently occurs that masters of vessels are induced to take a bill of health from the

British consulate when bound to another foreign port; this is quite unnecessary and only swells expenses to no purpose. Should the vessel be bound to any British port or a port in any British colony it will be necessary to obtain a bill of health from the British consul as well as that from the Port Authorities.

If there is not a consulate of the country to which the vessel is bound at the port she is in, it is usual for that country to have an understanding with some other friendly Power that their consulate shall do the necessary business for them. Many of the Latin countries, while having inadequate representation abroad, insist upon every formality being fulfilled ; therefore it is the shipmaster's duty, when so circumstanced, to find out what consulate is doing the business for the country to which his vessel is bound.

When bound to any port in the United States a master must be very particular that he has an American bill of health, and at every calling port on the way he must obtain a bill supplemental to the first one, from the American consuls at those ports.

Omission of this will entail serious delay at the American port of destination; this also applies when bound to any American colony.

Ship's Articles. When a vessel is going to be more than twenty-four hours in any port the articles must be lodged at the shipping office if it is a British port, or a port in any British colony; if it is a foreign port, then at the British consulate, whether there is going to be any change in the crew or not.

Ship's Register. Should the vessel be making any prolonged stay for the purposes of taking in or discharging cargo at any foreign port, the register must be handed to the British consul with the articles.

United States Tonnage Certificate. Should any ship foreign to the United States make more than three calls at any port in that country in any year, that ship will be exempt from paying further tonnage dues during the course of that current year. A certificate is handed the master each time he pays the tonnage dues, which should be carefully attached to the register, that they may be produced in the event of the ship making more than three voyages to a United States port in any one year.

If the vessel has been fumigated during the voyage it is necessary for the certificate of fumigation to be produced; in the absence of this certificate it would probably be necessary for the vessel to again undergo this troublesome and expensive operation before the port medical officer would grant pratique.

Protest. Immediately the vessel is entered at the Custom House it is the master's duty to go to a notary public, if in a home port, and note protest, or, if the vessel has sustained damage before arriving at her discharging port, and calls at any port for bunkering or other purposes, then at the first port that she happens to call at after sustaining the damage. If in a foreign port, he will note protest at the British consulate.

Should any damage be found to the cargo while discharging the same, it will be advisable to see whether the damage will amount to as much or more than the notary would charge for extending protest. Should the damage not declare itself before the time of departure, then by taking a copy of the protest it can be extended at any place or time within six calendar months of the date of noting protest.

The usual charge for extending protest is about £8 8*s.*, but should it be at all long, the expense will be greater, as the fees are charged by the folio.

The master should present himself at his owner's office each morning while in a home port, and as often as he may from time to time be instructed to do so. When in a foreign port he should present himself at his agent's or charterer's office each morning the office is open for business, in order to sign bills of lading, or to take such instructions as may be necessary.

Should he be required to attend his agent's or charterer's office at any other time, it is his duty to do so. Should circumstances arise on board his vessel that make his presence on board imperative, he must always bear in mind that his first duty is to his vessel and the cargo under his charge.

A shipmaster has at times to exercise considerable tact in the transmission of his business. His relations with his agent should always be of the best; he should treat his agent or charterer with the same deference as he would his owner, and defer to the judgment of the agent or charterer in all things, but he need not take the orders given by them should he think them prejudicial to his owner's interest.

Should the agent urge the master to take some course that the master knows to be a wrong one, it is his duty to try to dissuade him from urging that course by every means in his power, and he should only deviate from the agent's wishes after he has exhausted all his powers of persuasion and suggestion. Should the issue be great it is the master's duty to communicate the facts to his owner and to ask his advice.

While the shipmaster should, speaking broadly, always act according to his agent's instructions, yet there may be occasions when, if he did so, he would be acting contrary to his owner's wishes or interests. Should such an occasion arise he must feel sure of his ground and then take a line for himself.

When communicating with his owner by cable it is always advisable to use a code that gives the fullest detail for that particular class of business, and, of course, one of the codes that his owner makes use of. It is always better to put in a word too many than to skimp the message and so destroy its meaning. It is to be remembered that you are using a medium (which at the best of times is a poor one) to convey full information upon a subject that you are well conversant with, to one who, up to the time of his receiving your message, would be in ignorance of any events leading up to the circumstances that would cause the master to communicate with the owner. Should the message not be explicit it would not enable the owner to fully grasp the subject at issue and to give the master instruction clearly. The lack of clearness frequently necessitates the cost of an inquiry message, besides the loss of time and worry occasioned thereby.

Port officials frequently require very tactful treatment, and it is the master who receives these officials on board with cordiality and courtesy that will obtain the best attention.

The indisposition of a member of the crew on arrival at some foreign port at once places a great deal of power in the hands of the port medical officer should he be at all inclined to exercise it, while he can afford valuable help to a master in getting the man placed in some hospital. Many times the port medical officer will stay a little after sunset in order to pass a vessel that is under the command of a friendly master, thus saving the owner much valuable time; in fact there are many ways by which he can give prompt dispatch to a vessel. It must also be borne in mind that a master who is unfriendly with the port medical officer may again visit the port and may then have to ask favours.

Custom House officers in some of the out-of-the-way places have it in their power to assist in the dispatch of a vessel. It sometimes occurs that the necessary permit to work overtime has not been obtained from the Custom House through some oversight or forgetfulness, and it is the master who has considerately treated the officer in charge of the vessel that will be allowed to continue the work after hours until the permit is obtained.

A little time spent upon small courtesies to officials will usually be amply repaid, if not at once, then during some later visit to that port; therefore it is the master with tact who can always get his work through with the minimum amount of trouble and a saving of time to his vessel.

Pilots. Pilots sometimes study their own convenience in getting away from the vessel. They can advise the master that it would be better to come to an anchor for a time in order to defer their getting away from the vessel until daylight; or should they have reason to think that the sea is rough where their cutter is stationed, they would prefer to wait a little until the sea moderates. Such cases as the above do not frequently occur, but the master should use discrimination and judgment before he consents to delay, and not take the pilot's statements without casting round for the reason that dictates the course he wishes to take. It is well known that at some ports pilots prefer getting away from the ship during daylight; this practice should be carefully guarded against.

At the same time the master should not forget that he is in the pilot's hands, and he should only use discreet pressure.

The master should never take the command out of his pilot's hands under any consideration, except when the man is ill, under the influence of liquor, or when the ship is following a dangerous course and the master can clearly see how to avoid the danger. The master should see that all the pilot's orders are strictly carried out; that the helmsman is good and promptly obeys the pilot's orders; that the officer works the engine-room telegraph in accordance with the pilot's instructions and blows the whistle when ordered to do so; that a lookout is placed; and that the regulation lights are burning brightly. Should the master consider some particular action necessary, such as making a signal, by means of the steam whistle, to an approaching vessel to denote the course he intends to take, he should make the necessary suggestion to the pilot, etc., but not in such a manner as to hamper the pilot in his business of taking the ship to where she is bound.

Showing your Colours. A ship belonging to a British subject should hoist the proper national colours (*a*) on a signal being made by one of his Majesty's ships, (*b*) on entering and leaving any foreign port, (*c*) if over 50 tons register, upon entering or leaving any British port.

If default is made on board any such ship in complying with this section of the Merchant Shipping Act, the master shall, for each offence, be liable to a fine not exceeding £100.

Always hoist the quarantine flag on entering a port and keep it flying until pratique is given.

Surveys required. Upon arriving at any port before breaking bulk the master should inquire of his agent whether it is customary to hold a survey of the hatches; but should the master anticipate any damage it is his duty to have a surveyor or port warden (where there are wardens) on the spot when the hatches are removed, that he may certify that the hatches were efficiently covered and protected. The surveyor will attend daily for the purpose of making inspection of the stowage of the cargo, dunnage, etc.; and when the cargo is all out he will survey the damaged cargo, adjust claims (if any) upon same in the ship's interest, and give the master a certificate upon the hatches, stowage of the cargo, and the dunnage under and round the cargo.

Before taking in cargo it is usual at many ports for the master to call in a surveyor, that he may grant a certificate to the effect that the vessel is clean and ready to receive and carry a dry and perishable cargo to any part of the world.

When loading general cargo in the United States it is usual for a surveyor to be appointed by the ship's agents or charterers, or by the local board of underwriters, as the case may be, whose duty it is to inspect the stowage from time to time and grant the master a certificate when the ship has completed her loading. This certificate is of value, especially when the bills of lading contain the Harter Act clause.

Before taking in frozen produce it is the master's duty to have the holds surveyed, that the surveyor may be able to certify that the holds were clean, and the dunnage battens properly laid and secured. The refrigerating machinery will also be inspected when running, the refrigerating engineer's log-book produced for inspection, and the temperatures of the holds taken.

The surveyor, when he finds everything correct and the holds properly cooled down, will then grant the master a certificate to the effect that the holds were clean, the dunnage battens properly spaced and secured, the insulation tested and found in good condition, the machinery tested under running conditions and found to be efficient for keeping the temperatures down, and that the vessel is fit to carry frozen produce to any part of the world.

It is necessary to have this certificate before commencing to load, in case of any mishap to the insulation or machinery, or damage to the meat.

Should there be no surveyor at the port, the British consul on application will appoint a shipmaster whose certificate will, coming through the consul, be as efficacious as that of a surveyor, for, where there is no Lloyd's agent, the consul acts on behalf of British shipping and merchants.

The writer has frequently acted in the capacity of surveyor for Lloyd's, and as it brings in certain fees, while the labours are anything but arduous, it is a source of augmenting a shipmaster's income to be sought after.

COMPUTATION OF DRAFT

Centre of Gravity. The centre of gravity of a vessel perfectly upright and on an even keel lies immediately below the intersection of a longitudinal line drawn fore and aft in the centre of the vessel, and that of an athwartship line crossing the former at right angles in the middle of her length. The centre of gravity lies at some point below this intersection, varying in distance from it as the centre of weight of the cargo is raised or lowered.

For the purposes of this article it is assumed that the centre of gravity lies midway between the water-line and keel.

As the centre of gravity moves towards either end of the vessel so also does the inclination of the keel alter in a corresponding degree.

Formula for finding the Change in Draft. To the draft of the vessel apply the number of inches equivalent to the weight loaded or discharged, taken from the displacement scale both the same way, for she has increased or decreased her displacement in accordance with the difference of weight. We have now somewhat cleared the way, and are ready to apply our formula.

Where w = Weight.
,, D = Distance the centre of weight has been moved *plus* or *minus* the distance the centre of gravity has been moved.
,, W = Displacement of vessel.
,, G = First centre of gravity.
,, G_1 = Second centre of gravity.

Then $\frac{w \quad D}{W} = \left\{ \text{Distance centre of gravity has moved.} \right.$

To each of the corrected drafts apply half the distance the centre of gravity has moved, the one to be added and the other subtracted as the weight has been increased or decreased forward or aft. The result will be the present draft of the vessel.

The distance between the centre of weight and the perpendicular drawn through the intersection of the horizontal and transverse sections of the vessel can be ascertained from the builder's plan of the vessel to within a foot. As the ballast-tanks at the ends of the vessel taper off, the centre of weight contained in them will have to be determined by judgment. The holds in the ends of the vessel will have to be treated in the same manner.

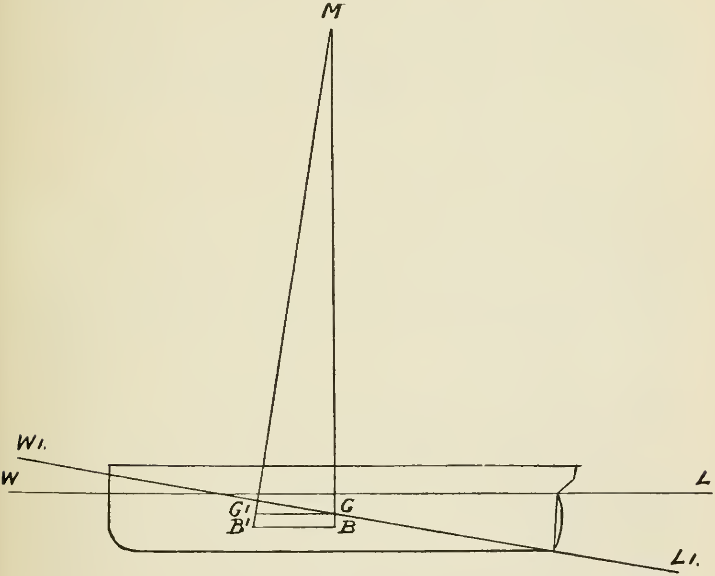


Fig. 1.

Longitudinal Metacentre. In Fig. 1, at some distance above the hull of the vessel, there is a point marked M; this is an imaginary point upon which a vessel may be said to oscillate were she free, and is known as the *longitudinal metacentre.* The metacentre is always in the same vertical line as the centre of buoyancy and the centre of gravity while stationary.

In short vessels of deep draft the longitudinal metacentre will be at a height less, and in vessels of a great length and light draft greater, than the length. This is easily verified in each individual vessel.

In modern cargo vessels the height of the longitudinal metacentre above the centre of gravity is about equal to the length, and the following calculations have been made upon this hypothesis; but should greater accuracy be demanded it will be necessary to find the true metacentric height for each displacement.

Zero from which to measure Distances. When taking the "Distance" for the formula, the difference of draft will be the correction, either *plus* or *minus*, to be applied to the distance as taken from the centre of the vessel, *i.e.*, the centre of gravity when the vessel is on an even keel.

Should the vessel be six feet by the stern the centre of gravity will be six feet aft of the centre of the ship. If the weight to be dealt with is at the fore end of the vessel, this difference of draft, added to the distance between the centre of the vessel and the new centre of gravity, will be the true distance required.

This formula will be found particularly useful when taking in a quantity of dead-weight

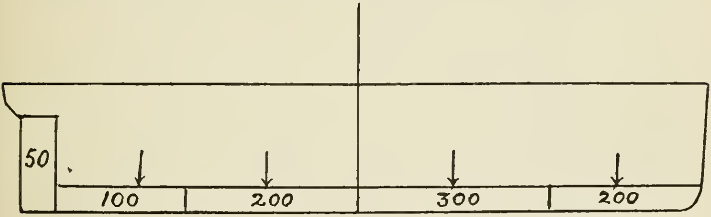


FIG. 2.

Displacement, 11,000 tons. Displacement Scale, 40 tons to inch. Draft forward, 21–00 ft.; Aft, 24–00 ft.

cargo, and filling up with light cargo, so that the vessel, when full, will be down to her marks.

The writer has found it particularly useful when on a long passage to find when the vessel has come to an even keel, and what effect certain tanks will have upon her trim.

The action of filling or emptying a ballast-tank can be accurately foretold, also the draft of a vessel at the termination of a long voyage after burning large quantities of bunker coals.

	′	″		′	″	′	″
			Diff. 3′	21	0	24	0
(3) $\frac{200 \times (47-3)}{10,800}$ =	2)0	9·7	Rise	–	5	–	5
Corr.	0	4·9		20	7	23	7
			Corr.	+	4·9	–	4·9
			Diff. 2′	20	11·9	23	2·1
(1) $\frac{200 \times (154+2)}{10,600}$ =	2)2	11·3	Rise	–	5	–	5
Corr.	1	5·6		20	6·9	22	9·1
			Corr.	–1	5·6	+1	5·6
			Diff. 5′	19	1·3	24	2·7
(5) $\frac{50 \times (190-5)}{10,550}$ =	2)0	10·4	Rise	–	1·2	–	1·2
Corr.		5·2		19	0·1	24	1·5
			Corr.	+	5·2	–	5·2
			Diff. 4′	19	5·3	23	8·3
(4) $\frac{100 \times (134-4)}{10,450}$ =	2)1	2·9	Rise	–	2·5	–	2·5
Corr.	0	7·4		19	2·8	23	5·8
			Corr.	+	7·4	–	7·4
			Diff. 3′	19	10·2	22	10·4
(2) $\frac{300 \times (53+3)}{10,150}$ =	2)1	7·8	Rise	–	7·5	–	7·5
Corr.	0	9·9		19	2·7	22	2·9
			Corr.	–	9·9	+	9·9
			New Draft	18	4·8	23	0·8

How to find the Longitudinal Metacentre. Note the vessel's draft very carefully fore and aft (when in very smooth water, such as a dock), to the nearest quarter of an inch if possible; add a known weight to one end of the vessel; compute her inclination of keel by the addition of the weight as shown in the preceding formula, upon the hypothesis that the metacentre is the same height above the centre of the vessel as the length of the vessel; then again carefully take her draft; a simple proportional sum will give the true metacentric height at that displacement.

Where OI = Observed inclination of keel.
,, CI = Computed inclination.
,, LV = Length of vessel.
,, M = Metacentric height.
OI : CI : : LV : M.

An excellent way to add the weight is to fill the aft peak tank with water through a tested meter; it can be very cheaply done at all our home ports. The tank once filled through a meter has its capacity more accurately defined than that usually given in the plans supplied by many of the shipbuilders, and the weight is

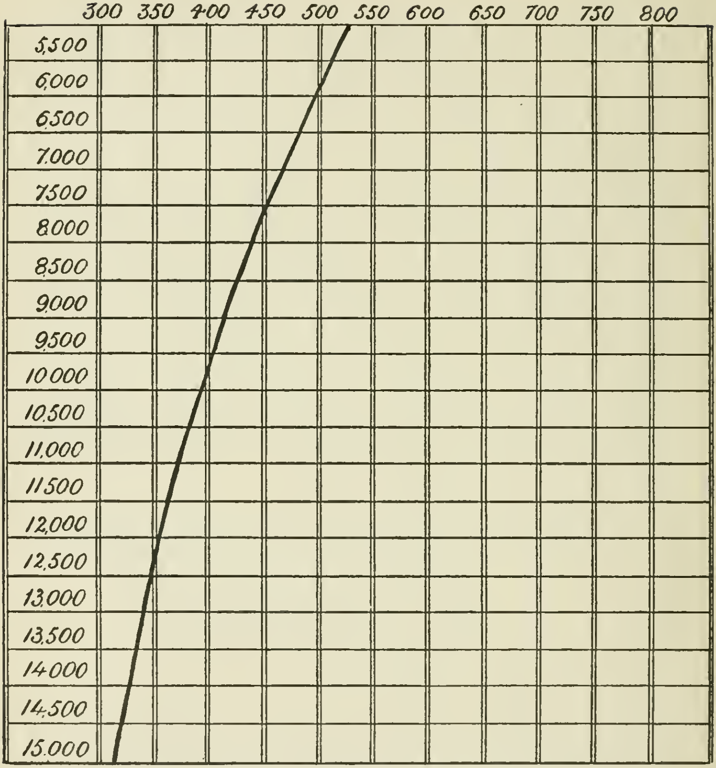


FIG. 3.

easily manipulated. Having once tested the capacity of the tank, a record can be made and retained on board for future trials at other displacements.

The metacentric height varies with the displacement of the vessel ; therefore the metacentric height should be found when the vessel is light, half loaded, and fully loaded, or nearly so. Should any great difference of metacentric height be observed when *light*, *half loaded*, *or fully loaded*, a curve can be constructed as shown in Fig. 3.

The correct metacentric height having been taken from the preceding diagram corresponding to the actual displacement of the vessel, proceed as follows :

Corr. M (from diagram) : Approx. M : : G : Corr. G.

Unless great accuracy is demanded, or there is a great discrepancy between the correct and approximate metacentres, it is hardly necessary to take this correction into consideration ; but it is advisable to find the above-mentioned correction, as it may be large in some types of vessels.

FORMULÆ

For finding the variation of metacentric height due to change of trim. The variation of metacentric height due to change of trim is always of such small dimensions that it can be safely neglected, but as most seamen insist upon great accuracy in their work it is as follows :

$$\sqrt{\text{Dist. M G}^2 + \text{Dist. G Gi}^2} = \text{New metacentric height.}$$

Vide Euclid, Book 1, Prop. 47.

For coefficient of fineness. The block coefficient of fineness is the decimal fraction of the displacement of the vessel as compared with that of a block having the same dimensions as those of the ship.

$$\text{Block Coefficient of Fineness} = \frac{\text{Displacement} \times 35}{\text{Length} \times \text{Breadth} \times \text{Depth.}}$$

Indicated Horse-Power necessary to drive a Ship at a given Speed.

S = Speed required.
L = Length.
12 = Constant.
D = Displacement.

$$\text{I.H.P.} = \frac{S\ D}{12\ L}$$

$$\text{Displacement} = \frac{\text{Length} \times \text{Depth} \times \text{Breadth}}{35.}$$

To find the Wetted Surface (Denny's Rule).

L = Length.
D = Depth.
1·7 = Constant.
C = Block Coefficient.
B = Breadth.

$$(L \times D \times 1{\cdot}7) + (L \times B \times C) =$$

Square feet of Wetted Surface.

To find the Indicated Horse-Power using the Wetted Surface (Denny's Rule).

Experience has taught that every 100 feet of wetted surface requires 5 I.H.P. for a speed of 10 knots; if additional speed is required then

10^3 : (Speed Req.)^3 : : I.H.P. at 10 knots : I.H.P. to give Req. Speed.*

---

* This formula applies to any particular type of vessel within ordinary speed limits.

Depression of Vessel when pierced in one Compartment.

When the water fills the compartment the buoyancy of that compartment is lost and the vessel sinks a certain distance, which, when multiplied by the water area of all the unpierced compartments, equals the cubic capacity of the lost space.

This is drawing upon the reserve buoyancy of the vessel, which may be said to be the volume of the space between the upper deck and all water-tight deck erections, and the water-level.

$$\text{Increase of Draft} = \frac{\text{Cubic capacity of holed compartment.}}{\text{Area of untouched water-level.}}$$

Should the holed compartment be full of cargo, it follows that the water will only fill up the spaces that are free of cargo, such as broken stowage, where the cargo itself will not contain any water. Should the cargo be of a fibrous or vegetable nature it will readily absorb a large quantity of water, but at the same time considerably less had there been no cargo there; should it be composed of flour or any kind of mineral the total quantity of water in that compartment will be less by the volume of cargo stowed there.

LOADING A STEAMER WITH A HOMOGENEOUS CARGO

Immediately there is sufficient cargo on board to ballast the vessel, and it is not certain that she will have sufficient stability when loaded without water ballast on board; pump out all ballast while the vessel is stiff and see that the tanks are thoroughly drained out. Do not run any water ballast into the vessel until it is certain that she will not have sufficient stability without. She can easily be tested, before completing the loading, in the following manner:

Land a few slings of cargo of a known weight on deck, as far as possible from the amidship line (four or five tons of cargo will be sufficient), and note the list that she takes. Should she list easily with a small weight and there is a considerable amount of cargo to go on board, get her upright again by shifting the cargo that is on deck into the hold, and continue loading until she shows her tenderness. When she shows her tenderness more palpably and, though the cargo and bunkers are evenly distributed, she takes a list, find from the displacement scale how much more cargo she should take to put her to her marks, and run in water ballast in a suitable tank to half that amount. When loaded the vessel will have sufficient stability, and if it is arranged that the coal stowed in the upper bunkers is burned first, as she gets to sea she will rapidly become stiffer.

Water ballast can nearly always be run into a tender vessel, but it can very rarely be pumped quite out, the reason for which is not hard to find. Should the vessel be nearly loaded before pumping the water ballast out, and it is then decided that she will have sufficient stability without any ballast, in such case, unless she is very stiff indeed, when the water becomes slack in the tank she will take a list, which will increase as the tank approaches emptiness, for she will not have so much stability as when the tank was full; besides which she will have water on one side only and it will be impossible to drain all the water out of the tank, as the suction pipes are invariably situated at some distance from the side of the tank.

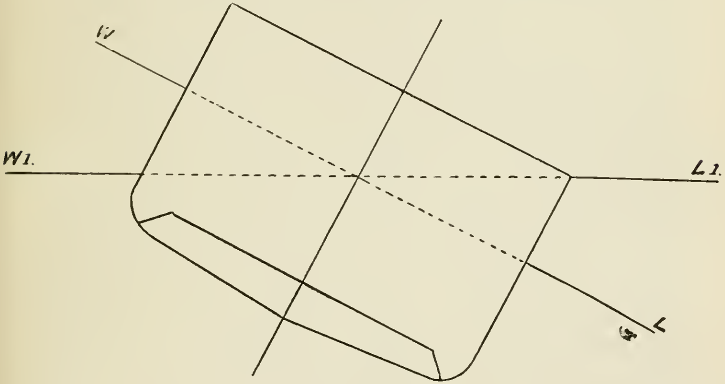


FIG. 4.

Should the vessel take a few degrees of list at any time, by running water into her tanks she will at once possess greater stability, even though the list may increase at first. As the tank fills and the water rises on the higher side, the vessel will assume its upright position, unless there is more cargo on the one side than the other.

With a tender vessel, always fill the smallest tank first, as it is easily pumped out after a larger one is run up: when at sea it is advisable to bring the vessel's head to wind and sea.

Should a vessel at any time be found to list easily when a small weight has been put on one side of her, it will at once be apparent that she is tender, but should she have a high freeboard she will not turn over by reason of a greater breadth being exposed upon the surface of the water. As long as that breadth is on the increase and no water can find ingress she will become stiffer from any internally applied force, but should the water rise over the gunwale the breadth of the vessel at the surface of the water will diminish so rapidly with any increase of list that the vessel will lose the support upon one side and will be in danger of turning over.

It will be seen from Fig. 4 that as a vessel heels a certain amount, her breadth upon the surface of the water increases upon both sides of her: the wedge-shaped portion upon the side that was immersed when upright becomes exposed, while at the same time a wedge-shaped portion of similar dimensions becomes submerged upon the low side.

BEFORE TAKING IN CARGO

Before taking in cargo the chief officer should take up all the limber boards fore and aft, and after satisfying himself that they are clean, that the drains between each floor plate are all clear, *i.e.*, not blocked with cement or dirt, and that the strums round each suction pipe are all clear, he, accompanied by the second engineer and the ship's carpenter, shall inspect the bilges. Water should be pumped into the bilges through the suction pipes and pumped out under the inspection of all three. The 'tween-deck drains should have a bucket of water poured down them in order to see that they are all clear and that there is a free run of water to the bilges. An entry should be made in the log-book that the bilges and rose-boxes were inspected and passed by the engineer upon a certain date.

Dunnage. The dunnage should be laid under the chief officer's inspection. In a steamer with a cellular double bottom and a 3-inch ceiling laid upon 1-inch cross-battens, two inches of dunnage laid fore and aft, or 1-inch dunnage wood, the lower tier laid fore and aft, and the upper tier laid athwart, will in most cases be sufficient on the flat of the floors; with three inches in the turn of the bilge, the lower tier of which, if of 1-inch, to be laid athwart; if of 3-inch then all is to be laid athwart.

In the 'tween decks 1-inch dunnage is sufficient for most cargoes, to be laid athwart; in the wings the dunnage should be doubled and kept a few inches from the side so as to allow a free run of the water to the drains. Should the cargo be of a perishable nature it is advisable to cover the dunnage with mats, and the mats carried right up the sides against the spar ceiling. If grain in bags is to be stowed, then the dunnage should either be covered with sails or gunny, to keep the loose grain from contact with the ceiling.

Care should be exercised to see that all the ventilators are free and not plugged with anything. This principally applies to insulated ships, whose ventilators are always plugged when carrying frozen produce.

Ship-log entries. *Sounding of Bilges and Tanks.* Each day an entry should be made in the log-book to the effect that bilges and tanks have been sounded both A.M. and P.M.

Ventilation. Ventilation of cargo strictly attended to and hatches removed for ventilating purposes when weather permits.

Regulation Lights. Regulation lights exhibited from sunset to sunrise.

Lookout. The names of the men employed on the lookout from sunset to sunrise, and should the weather be thick or hazy then the name of the man on the lookout at those times.

Inspection of Bilges. Whenever an inspection of bilges and rose-boxes takes place before taking in cargo, an entry should be made in the log-book, stating who made the inspection, and specifying the time and date.

Tanks. When a tank is filled and emptied, the time and date of doing so should be entered up in the log-book.

Stranding. Should the vessel ground or strand, the time and date of the occurrence should be carefully entered in the log-book together with the least water round her, the position of the ship, the means taken for getting her off, and the time of her floating. All entries to be made as briefly as possible and to the point.

Collision. The time and date of the occurrence, and the entry to be made as follows: "The '————' collided with us at such and such a time. Wind, ———. Sea, ———. Position: Lat. ———, Long. ———," and by cross-bearings if possible.

Loading. The cargo taken in each day, and the hatches worked, the times of working and the draft of water at the end of each day should be entered in the log-book. Should any cargo be refused through being in bad condition then the same should be entered up in the log-book; as also any other circumstances of interest that occurred during the operation of loading and discharging.

Ship's Papers required by the Master. In a home port, when clearing the ship at the Custom House, the master will require the following papers to hand in: *Register*, *A.A. Note*, *Jerque Note*, if the ship is leaving in ballast; *Manifest of Outward Cargo*, if any. (Should it not be made up by the agents it may be handed in within three days of the time of clearing.)

After paying the light dues for the next voyage, in advance, the master will be given a receipt for the same, which it is well to attach to the register. It will be necessary to produce the register for inspection, also the load-line certificate, both of which will be returned.

The collector will then cause the following papers to be handed to him: *Clearance, Victualling Bill, Bill of Health.* The *Manifest* and *Captain's Copies of the Bills of Lading* will either be handed to the master by the ship's agent or they will be mailed on to him. It is always advisable to have a copy of the *Manifest* or the Captain's copies of the Bills of Lading on board in case of having to enter a port *en route.*

In a Foreign Port. If bound to a foreign port, the master should obtain a bill of health from the consulate of that country to which his ship is bound.

On arrival at a foreign port, the master will have to produce his bills of health for the port medical officer's inspection, and to muster his crew. After the medical officer has satisfied himself that the crew are all in good health, and there has been no infectious disease on board, he will grant the ship pratique. The manifest of the cargo and of the ship's stores will be produced by the master for the inspection of the Custom's boarding officer.

Entering at the Custom House. The master will produce the following papers at the Custom House when entering: *Clearance* from the last port, *Pratique Paper*, *Bills of Health* from all the ports from whence cargo has been taken, and if a U.S.A. port then a *Supplemental Bill of Health* from each port touched during the voyage, *Manifest of Cargo*, *Manifest of Stores*, and *Crew List*.

Consular Clearance. The day before the ship is about to sail, should she be due to sail before the office hours, a clearance must be obtained from the British consulate, together with the register and articles, and upon that clearance and manifest of the cargo taken at the port, if loading, the Custom House will grant another clearance and bill of health; the ship will then be entitled to proceed. Should she be lying in a dock, a dock pass will be required in order to hand same to the dock authorities before leaving the dock.

When bound from a Chinese, Japanese, or Philippine Islands port to the U.S.A., it is necessary to have the ship fumigated before taking in cargo. When the fumigation has been performed a certificate will be granted by the U.S.A. consulate doctor, which will, upon production, exempt the ship from fumigation on arrival at a U.S.A. port, unless it happens that there has been a case of cholera, yellow fever, plague, or small-pox since the ship left her last port.

THE IMPORTANCE OF SOUNDING TANKS AND BILGES FREQUENTLY

So many accidents happen to cargo and insulation through the bilges not being sounded at least twice daily, and whenever a ballast-tank is being filled, that the writer has made a rule, in all the vessels of which he has had command, for the third officer to go round once a day with the carpenter, and to keep a separate record of the soundings in a book supplied for that purpose, in order to ensure that correct soundings be returned. The soundings obtained by the carpenter are entered each A.M. and P.M. upon a blackboard posted up in the engine-room for that purpose.

When a tank is being filled it sometimes happens that the air pipe has become corroded away close to the tank top, so that the water finds its way to the bilges and may reach the ceiling, and even the cargo. Leakages of this kind are more likely to occur when at sea with a vessel rolling or pitching in a seaway, but it is at all times necessary that the bilges in the vicinity of a tank that is being filled shall be sounded at intervals until the tank is quite full and the water shut off.

Latrine Pipes. Latrine pipes, which are usually made of lead, are frequently led through the 'tween deck to the ship's side, and may cause a lot of trouble in consequence of their becoming choked with refuse. There is no danger should the pipes be cleared in a proper manner, but it almost invariably occurs that, instead of the circumstance being reported to the chief officer, some zealous fireman or sailor forces a crowbar or some such instrument through the side of the latrine pipe and considers himself quite a genius when he finds that he has made a passage for the water. Unless the wells and bilges are kept carefully and constantly sounded, the carpenter some morning reports that there are some feet ot water in a certain hold, and cannot understand where it has so suddenly come from. On being questioned the carpenter will, without doubt, be ready to swear that he has sounded that hold during the previous twelve hours.

Some vessels are fitted with lead bends that pass through the wells between the tanks, and connect up with iron piping in the adjoining tank, while other vessels may have a pipe service which is led over the tank tops in the holds. After the vessel has been subjected to much straining during heavy weather, it sometimes happens that some of these pipes have been fractured, and when a tank is being filled the bilges overflow, and cargo is damaged. Again, should a heavy weight come violently into contact with any pipe casing, it may so jar the casing that the cast metal pipe will be fractured, with dire results when filling the tank.

Should damage occur to the cargo from any of the preceding causes, and the bills of lading contain a reference to the Harter Act, extend the protest, and, if you can, prove by means of a survey certificate while loading, that at the time of sailing the vessel was seaworthy ; the ship will then not be held liable for the damage, but the damage to the cargo will fall upon the underwriters of the cargo itself. The Negligence Clause in the bill of lading will also cover the ship.

BILLS OF LADING

There are many forms of bills of lading all more or less good, as each has been framed specially for use in a particular trade. They have occasionally to be brought up to date, and it is certain that if they are not thus modified, considerable injustice may have to be borne by one side or the other.

The writer suggests that when commencing to load at any port it is advisable for the master to obtain and study the blank bill of lading form that is going to be used, and see that the following Clauses are incorporated therein :

- *Ice Clause.*
- *Lie Afloat at all Times Clause.*
- *Towage Clause.*
- *Lighterage Clause*, if bound to a port with scant water.
- *Lien on Cargo for Dead Freight or Demurrage.*
- *Harter Act Clause*, if loading to or from a U.S.A. port.
- *Freight and all Conditions to be the same as Charter-Party.*
- *Demurrage and all Conditions to be the same as Charter-Party.*
- *Negligence Clause.*

Freight. Should the freight in the bill of lading not be the same as that of the charter-party, the charterer must pay the difference if lower before the master signs all the bills of lading ; if it is higher, the ship may have to refund the charterer for the difference.

When the bills of lading have been signed, the charter-party has no binding power, and only the bill of lading clauses are obligatory upon the consignee, who may have had no knowledge of the charter-party or its clauses.

When signing bills of lading in the United Kingdom the master must see that at least one of the set is a stamped copy, *i.e.*, the revenue stamp must be embossed upon the bill of lading itself. If the bills of lading are signed for a bank two stamped copies may be required out of the set of three, four, or five and the master's copy.

As soon as the bills of lading for any consignment are signed it is the custom for the shipper to lodge them in a bank, where he draws money upon them. The consignee at the port of destination has to redeem the bill of lading that has been sent by mail (either by the same vessel that brought the goods or by mail steamer), to the branch or agent of the bank that made the advance upon the goods. The consignee has to obtain the original from the bank that holds it, by paying the advance made before he can obtain possession of the goods from the vessel. Having become possessed of the bill of lading he presents it, together with the freight due (if the freight has not been prepaid), to the ship's agent, who gives him a delivery order for his cargo.

The consignee presents the delivery order on board the ship and the chief officer or delivery clerk gives him delivery. Briefly, the ownership of the cargo passes with the bill of lading, and as it often changes hands many times while the goods are in transit, it follows that the bill of lading is the only document that expresses any agreement between the owner of the goods and the carrier. The bill of lading should have the agreement fully stated so that any one interested in the goods can see their obligations; otherwise there is no obligation, and the ship will suffer.

There are usually four copies in each set of bills of lading; one is the original, two have the word *Copy* stamped upon them, and the fourth has the words *Captain's Copy* stamped upon it.

When loading in some of the Danube and Black Sea ports, where, after taking a certain quantity of cargo on board, the remainder has to be lightered down to the mouth of the river or harbour where there is more water, be careful not to sign bills of lading for it as if it were on board. It has been the custom for the bills of lading to be presented for signature as if the cargo was actually on board, and many masters have been induced to sign them. The bills of lading should have the following clause: "Alongside in lighters to be taken on board at ———," for it may be lost while in the lighter, or some of it may have to be shut out.

When signing bills of lading there are four very important things to look for, viz.:

(1) That the mate's receipts are attached to each set of bills of lading, and that the number of packages upon the bills of lading correspond with those upon the mate's receipts; the marks also must correspond. After signing the bills of lading the mate's receipts become the property of the master and should be taken away.

(2) That the port named upon the bill of lading is correct.

(3) That the date of shipment is correct, especially if early in the month. Bills of lading have been known to be ante-dated by unscrupulous clerks in order to satisfy a shipper that his goods have been taken on board during the past month, and by so doing enhancing the value of the goods. Should the master sign such a bill of lading he would, if detected, be liable to prosecution for fraud.

(4) That the rate of freight is correct. Should there be a charter-party the rate of freight should correspond with that in the charter-party.

When loading on the berth for a charterer, bills of lading are frequently presented for the master's signature at varying rates of freight, therefore, the master should obtain a guarantee from the charterer that in the event of the whole of the freight as per bills of lading being lower than that of the charter-party the charterer will pay the difference in cash before the vessel leaves the loading port.

Should the rate of freight be higher in the bills of lading than that of the charter-party, the master would have to make a refund to the charterer, to be paid out of the freight after the ship arrives at her destination and so earned the freight.

It is usual in these cases for the charterer of the vessel to arrange with his shippers to pay him some freight in advance so as to equalise the freight in the bill of lading and in the charter-party.

At the foot of the bill of lading it is usual for the following clause to be inserted (if not already printed there) immediately before the master's signature: "Weight, Quality, and Contents, unknown to me. ———, Master."

Remitting Freight Home to Owners. After collecting the freight it is usual to call upon the managers of the leading local banks, British banks always preferred, and try to get some preferential rate of exchange.

It frequently occurs that there is a little difference in the terms, especially if the currency fluctuates very much. Buy the draft (usually for thirty days' sight upon London, unless otherwise instructed by the owners) at the best rate of exchange obtainable, providing it is a first-class bank, and send the first exchange by the first mail, the second exchange by the next mail, and keep the third exchange in the cash-box as a voucher.

Some charter-parties call for the freight to be paid by a three months' draft on London, in which case the master will accept the charterer's draft, first satisfying himself by seeing the manager of the bank upon which it is drawn that it is approved.

Letters of Indemnity. Should there be any dispute when tallying cargo, do not take any letter of indemnity for the quantity that is in dispute. The most that any shipmaster should do is to have the quantity taken on board put in the bill of lading as follows: "So many —— bags or bales or cases of 'so-and-so,'" also "so many in dispute, if on board, to be delivered."

A letter of indemnity is fraudulent, for should the bill of lading (as in the usual course of events it will do) change hands, how is the consignee to whom the bill has been made over to know of the letter of indemnity? He takes the bill of lading at its face value. It sometimes happens that the merchant may be shipping the goods to his own order to sell in another country, but this is rarely done except by certain large firms. Speaking broadly, it is never safe to sign for more than what is actually received according to the ship officer's tally, and the utmost concession for the master to make is to have the number in dispute endorsed upon the bill of lading, "if on board to be delivered."

The condition the goods were received in should also be specified distinctly: If cases, "Cases stained or broken"; it bags, "Bags stained (either dry or wet stained), patched," &c. On no account take a letter of indemnity upon the condition of the cargo, for when the ship arrives at her destination, upon the goods being examined, it may possibly be found that they have suffered a considerable reduction in value, by reason of the stains noticed having reached the goods in the packages, and as the ship is no longer protected by the qualification, it follows that she will have to make good the loss.

Should the cases be of poor quality, the words "Insufficiently packed" should be put upon the bill of lading.

CHARTER-PARTIES

A vessel may be chartered to a merchant at a certain rate per ton. The merchant puts her on the berth and advertises her, thus subletting parts of her carrying capacity at any rate of freight that may at that time be offering, irrespective of the charter-party rate. The time for loading will be stipulated in the charter-party, also the rate of demurrage.

The time allowed for discharging will also be mentioned, possibly at the rate of "Custom of the Port," or, what is more usual, "as fast as the vessel can deliver."

The charterer has nothing more to do with the vessel after she is loaded and the bills of lading are signed, therefore the master has to see that the bills of lading contain all the obligations of the charter-party, which may now be said to be discharged. As the cargo is in the master's possession, he will be able to obtain satisfaction by keeping the cargo until all his just claims are satisfied, provided he has seen that the various stipulations of the charter-party are so stated in the bills of lading that all interested in the cargo may understand their obligations.

Where there is a simple charter stipulating for the carriage of a certain quantity of cargo, it usually stipulates the quantity, *plus* or *minus* ten per cent., that the vessel may be able to command sufficient cargo to complete her loading.

The *lay-days* may be stipulated for in a variety of ways.

Running Days. These include Sundays, holidays, or bad weather days.

Working Days. Sundays and holidays excepted.

Weather Working Days. Sundays and holidays, and also all days upon which the weather is too bad to allow the ship to work, are excepted. The captain of the port usually decides which days are *non-working* days.

When loading a full cargo (not upon berth terms) the number of discharging days, or else the rate of discharging per day, will be specified. The demurrage per day will also be incorporated in the charter-party. Both the lay-days and the demurrage should be specified in the bills of lading.

When the rate of discharging is stipulated for at the rate of —— tons per day, or working day, or weather working day, as the case may be, it means that the average output until the vessel is discharged is to equal that amount.

Dispatch Money. It may be mentioned in the charter-party that dispatch money at the rate of £—— per day will be paid should the consignee take more cargo from the ship than is stipulated for, and so save lay-days. Again, it may not be so stipulated in the charter-party, but should the consignee be able to take more cargo from the ship than obliged, he will try to make an agreement with the master for a certain sum for each day saved.

The master will, of course, try to make the best terms possible for his owners, taking into consideration the future employment, if any, of the vessel.

It is advisable to draw up a written agreement to read as follows: "Should —— days be saved I agree to pay £———— at the rate of £— for each day saved. Should only —— days be saved, then at the rate of £— [a smaller amount] for each day saved."

The time given in the charter-party is usually so ample for the work to be done that the consignee would, at his usual rate of working, take out far more per day than that specified for; hence he incurs no extra expense in working faster.

When all the cargo is for one consignee it is usual for the following clause to be incorporated in the bills of lading: "All conditions and stipulations of the charter-party to be fulfilled."

When loading for the owners on the berth (*i.e.*, without any charter-party), a bill of lading will be granted for each line of goods to each individual shipper; but it frequently occurs that a shipper may have a large consignment of a particular class of goods, such as bridge or railway material, case oil, &c., in which case it is usual for an agreement resembling a charter-party to be entered into. This agreement will stipulate the quantity to be discharged from the ship daily, or the number of days allowed for discharging, also the demurrage charged per day in the event of the consignee failing to take delivery in the time specified, the same as in a charter-party. At the same time, should all hatches that contain that particular consignment not be available, or should all the goods be stowed in one hatch and the ship not be able to deliver quickly enough, the consignee in the former case would not accept the ship until all hatches containing his goods were available; and in the latter case he would not hold himself bound by the lay-days, if he were able to receive faster than the vessel could deliver.

Notice of Readiness. Immediately on arrival at a port, whether the charterer is the agent or not, the master must give notice of readiness in writing. The notice need not be accepted until the ship is entered at the Custom House; after she is entered the master should ask for an acknowledgment of his notice. Charter-parties usually contain a clause to the effect that time will not commence until twenty-four hours after the vessel has been entered at the Custom House and written notice has been given. In the absence of any stipulation to the contrary the lay-days should commence at noon if the notice is handed to the charterer or consignee before noon, or at the time the stevedores usually commence work on the following morning if the notice is not handed in until after noon on the day of arrival.

On no account omit to hand in the notice to the charterer or consignee immediately upon arrival; but should the work of loading be commenced by the charterer, or the discharging by the consignee, or in the event of the charterer's or consignee's stevedores not discharging the vessel, then if he sends lighters to receive the cargo that is put out and accepts delivery it would suit the master better to tacitly agree with the charterer or consignee to waive the notice.

Demurrage. Twenty-four hours before the lay-days have expired the master must give notice to the charterer or consignee in writing that the ship will come on demurrage at a certain time on the following day, and ask for an acknowledgment. Demurrage should be paid day by day and on Saturday for the Sunday. It is usual when dealing with a reputable firm or merchant to accept a written agreement that they will pay all demurrage when the cargo has been discharged.

Freight. When the charter-party gives the consignee the option of weighing out the cargo and paying freight upon the quantity delivered, or to accept the bill of lading weight less two per cent., the consignee will declare that option before breaking bulk. When the master has to collect and remit the freight home to his owners after paying all disbursements, and in dealing with a firm that he is not acquainted with, or whose credit he may have reason to think is doubtful, it would be well for him to get some freight paid on account. After a considerable part of the cargo has been delivered the master is justified in asking for an advance of freight, and while there is cargo on board of sufficient value to pay freight upon the whole : or, the master may ask for a bank guarantee for the freight. It sometimes requires considerable tact and judgment to keep on the right side of the charterer or consignee without running the risk of plunging the owner into expense, should he, or they, prove to be bad payers at the end.

Lay-days. There are two dates mentioned in a charter-party, that on which it is arranged for the agreement to come into force, and that on which the agreement is cancelled by reason of the vessel not presenting herself ready to fulfil her engagement.

The earliest date that a vessel's lay-days are mutually agreed to commence is always mentioned in the charter-party. Should the vessel arrive at her loading port and be ready to take in cargo before the date fixed on, the charterer has the option of either accepting her at once or not, as it may best suit him. The master should, of course, try to get his vessel accepted by giving notice of readiness to the charterer, but he should never allow the charterer to commence loading before making an agreement with him that the vessel's lay-days are to commence at the time of her commencing to load. In cases of this kind it is usual for an agreement outside the charter-party (without prejudice to the charter-party) to be entered into by the master and the charterer when, possibly, the days occupied in loading operations before the earliest charter-party date may be counted as half lay-days, and to be taken from the number of lay-days specified in the charter-party.

The date on which the agreement may expire is also specified in the charter-party. It need hardly be pointed out how necessary it is on the part of the shipmaster for his vessel to arrive at the stipulated port before the time expires.

Should he find that it is impossible for his vessel to arrive at her loading port between her specified dates, he must not assume that he has not to take his vessel there, but on the contrary he must exercise every effort to get his vessel there as soon as possible, unless instructed to the contrary by the owner.

On arrival at the loading port the master must give the charterer a notice of readiness in the usual manner, and enter his vessel at the Custom House. Should the charterer refuse to accept the vessel owing to the closing date in the charter-party having elapsed, the master should cable the owner, that he may either arrange some reduction of freight, or, failing that, find employment for the vessel elsewhere.

The above applies equally to cases when a vessel is chartered to load outward from her discharging port, and where she cannot be ready to load by the closing date of the charter-party.

Briefly it may be summarised as follows:

The vessel when chartered must proceed to her loading port, and must be presented to the charterer unless the owner and charterer have mutually arranged otherwise.

On the arrival of the vessel at the port of loading, after the master has given written notice to the charterer and entered his vessel at the Custom House, should it be found that the charterer, from any cause whatever not stipulated against in the charter-party, could not load the vessel, the master must not take his vessel from that port until all his lay-days have expired. It has frequently occurred that where the charterer has acted as the agent of the vessel, he has, in his capacity as agent of the vessel, ordered the master to proceed to another port, possibly not far removed from where the vessel was lying, on the understanding that cargo would be found for the vessel at that port. On no account must the master take his vessel away from the port mentioned in the charter-party unless so instructed by the owner. Should he take any course than that stipulated for in the charter-party he will have broken his agreement, and instead of obtaining damages from the charterer for his failure to load the vessel, he may find himself liable for a breach of agreement in that he took his vessel away without giving the charterer any chance to load the vessel.

It is the duty of the master to keep the owner informed of any events that may influence the earning power of the vessel under his command; should he not be able to communicate promptly with the owner, he must, at the expiration of his lay-days, put in a claim for breach of agreement. The charter-party usually contains a clause to the effect that any failure on the part of the charterer to load the vessel will result in an indemnity, to be paid to the owner of the vessel, of a sum not to exceed the whole freight, as if the vessel had earned it.

In the event of the charterer refusing to settle with the master on the charter-party terms, the master must immediately enter a protest at the British consulate if in a foreign port—if at a British port, then at a notary public—give the charterer a copy of the protest, and wait instructions from the owner.

Payment of Demurrage. When demurrage has been incurred the master should on no account proceed to sea until it has been paid. Should the vessel be delayed pending settlement, the time that she is so delayed will be charged for as demurrage, or, in other words, the demurrage will run on until a settlement has been effected.

At some of the minor ports where there is little shipping, or where the agent might not be a man of great experience in shipping matters, the agent may order the master to proceed to his next port, at the same time assuring him that he, the agent, will collect the demurrage and remit it to the owner. But, unless the owner is thoroughly conversant with the matter at issue and has instructed the master to proceed on his voyage, the master should on no consideration leave the port until a settlement has been effected. The consignee will be far less likely to pay up after the vessel has gone away, and points may be raised by him in the master's absence that the agent will not be able, without the master's assistance, to successfully combat.

PARTICULAR AND GENERAL AVERAGE

Particular average is a term used to denote a particular loss to be borne by a particular interest, and may be briefly summarised as follows :

All partial damage to a ship, such as the accidental striking of a ship on a rock, or by reason of getting aground, fouling a pier-head, collision with another ship, or by perils of the sea, hatches being broken and water getting in, being on fire, the loss of boats, spars, sails, or propellers. All the preceding losses are borne by the particular interest, viz., the underwriters of the ship, if insured.

In allowing for repairs a deduction of one-third new for old is made. The one-third deduction is made from the cost of the labour and material with the following exceptions:

For a ship making her first voyage all repairs are allowed in full, anchors and propellers are allowed in full, and on chain cables one-sixth only is deducted.

General Average. A general average loss is that which has been sustained by the sacrifice of some part of the ship or cargo for the safety and preservation of the whole. The loss will not be the subject for a general average contribution unless it is some voluntary sacrifice of part of the ship or cargo to prevent the whole from perishing, or some extraordinary expense incurred for the common benefit of both ship and cargo. The loss must not be any ordinary peril of the sea, but some deliberate and voluntary sacrifice in time of danger, intended to prevent a greater loss or damage, by the master. It must be something quite beyond ordinary wear and tear, which would fall upon the shipowner solely. The loss must be judiciously incurred and the sacrifice must accomplish the object contemplated, at least for some short time.

The following have been held to be subjects for general average contribution :

Where some part of the cargo has been jettisoned, masts cut away to ease the ship, boats sacrificed to obtain assistance or in laying out anchors, cables slipped and anchors abandoned to prevent a vessel driving on the rocks or into collision. Loss sustained from running a vessel on shore deliberately in order to save part of the ship or cargo, &c. When a vessel has incurred some accident and she puts back to repair that damage. And when a vessel has been on fire, and her cargo, together with herself, has suffered damage from the water employed in putting out the fire. All stores expended while repairing the damage, or putting out the fire, crew's wages and subsistence will be charges upon the general average.

If deck cargo is jettisoned in time of danger, the cargo below decks does not contribute, but deck cargo contributes to any average contribution.

If any loss occurs that will give rise to a general average claim, the particulars should be briefly and concisely entered in the mate's log-book showing that the sacrifice was necessary, and that it was done for the benefit of both the ship and cargo. The master has a lien on the cargo until all the general average claims due from it are paid. An average bond will be drawn up and the master's lien exercised until the consignees pay the claims that are put forward on this account.

The ship is to be valued according to the condition she is in after the damage. The freight contributes so far as it has been earned.

Passengers' luggage is not liable to contribute, but if it is sacrificed for the general benefit then it must be contributed for. As a general rule, "that which pays no freight pays no average."

The following papers must be obtained by the master to enable the owner to get the average adjusted :

All the survey reports of the ship and cargo. These reports should include the preliminary survey containing the surveyor's suggestions as to the repairs it will be necessary to execute.

The survey upon the cargo as it is delivered, or in the event of the accident having occurred at some intermediate port and the cargo is discharged for any purpose, then a report upon the general condition and re-stowage of that cargo should be drawn up. The survey upon the vessel after the repairs have been executed, stating how the repairs have been carried out.

The survey reports should be obtained in triplicate if possible.

Should the average contribution be on account of fire, and the damage sustained by the water employed in putting the fire out, careful distinction should be made in the survey reports between the amounts damaged by fire and by water respectively.

The extended protest should also be in triplicate: one copy must go to the owner, one left with the agent, and one should be kept on board the vessel.

Vouchers for payments made while under average, such as crew's wages and subsistence, repair bills, stores to replace those lost or destroyed, stevedores' bills, survey bills, and any charges that the vessel may have incurred as salvage. All these accounts should be signed by Lloyd's surveyor and Lloyd's agent.

The time that the certificate of seaworthiness was granted or the certificate of classification, whichever the case may be.

Should the cargo have been discharged and reshipped, then the time that it was reshipped on board should be sent to the owner.

Copies of the specifications of the repairs and the tenders received, together with the newspaper cuttings of the advertisements, should be sent to the owner.

Accounts of every description should be sent, including those of cash drawn by the master from the agent.

All the preceding papers will have to go to the average adjuster employed by the owner of the vessel.

Extending Protest. When extending protest it is not enough that the mate's log-book be left with the notary for him to draw up the document, unless it be that the notary is a man of great experience in that particular line. After a rough draft has been made by the notary, the master should carefully go over it with the log-book, and satisfy himself that no salient feature has been omitted, and must consult with the notary upon any questionable points before a fair copy is made and the extension of protest executed.

How the Average is arrived at, or "struck." A survey is made of the ship and cargo as soon as possible after the accident by surveyors, who will assist the master to this end, and the damage to the ship and cargo ascertained.

An estimate of the approximate cost of the repairs to the vessel, both temporary and permanent, will be arrived at; also the best course to adopt with the cargo in the interests of all concerned.

Having arrived at a fair estimate of the cost, it remains to be decided whether temporary repairs should be effected sufficient to make the vessel seaworthy to continue her voyage and reach home (where possibly the repairs will be both better and more cheaply executed), or whether the vessel should be permanently repaired at the port she is at.

Cable the owner the cost of both temporary and permanent repairs, as also, what is very important, the time necessary to execute the repairs; and ask for instructions.

Having arrived at a decision as to the temporary or permanent repairs, continue to keep the owner posted up in everything relating to the ship and her cargo. It may here be said that the cost of all cablegrams will be a charge upon the general average.

The value of all interests must now be considered.

The value of the ship is taken in her damaged condition, the value of the freight, and the invoice value of the cargo are all added together, and a percentage of the whole of sufficient dimensions or value to pay for the cost of repairs to the ship. Ascertain the cost of the crew's wages and victualling while under repairs, stores consumed, extra labour handling the cargo, salvage charges incurred, ship's furniture and stores sacrificed or lost while in duress, damage to cargo, loss of freight should the ship be engaged for another cargo and loses same by reason of her accident, survey fees, cablegrams, agency and average adjuster's fees, and all other charges that may be legitimately incurred by reason of the accident and sacrifices.

A meeting should now be called of Lloyd's agent (should the vessel be insured in Lloyd's), the local underwriters who may be interested, Lloyd's surveyor, the ship's agent, and the master of the vessel, at which will be decided what percentage should be paid by the contributing parties.

Average Bond. An average bond is an instrument drawn up by the master or the ship's agent; the form most widely used is that known as Lloyd's average bond. It is headed by a statement that a certain percentage is demanded, and that all the moneys collected by the agents from the consignees of the cargo will be paid into a General Average Fund, at a certain bank, in the joint names of two men (of whom the ship's agent is usually one), who are to act as trustees for all the contributing parties, of the ship, and the owner.

The master of the ship opens the average bond by signing first.

Each consignee pays the agent, before receiving his cargo, the percentage upon the value of his goods for which the bond has been made out. The value of the goods is usually the invoice value, *plus* ten per cent., but in some ports the landed value of the goods is taken by the valuators appointed by the underwriters and the ship.

Each consignee signs the average bond against the sum of money he has paid to the agent, and the agent gives a receipt on a special form for the money handed in.

After the average bond has been completed by every consignee having contributed his necessary quota, it is sent to the average adjuster (who is appointed by the owner of the vessel). The average adjuster apportions the amounts due the vessel after valuation, freight, and cargo (from the average fund); the balance, after the apportionment is made, being paid over to each interest, whether owner or consignees, *pro rata*, by the trustees of the average fund.

Specifications for Repairs. A specification for repairs to be executed cannot be too carefully drawn up. Before attempting to specify what has to be done, the whole situation must be very carefully gone over and copious notes taken of the work to be done, and the material to be used. No detail must be left out, and nothing left unmentioned that can possibly become an extra charge upon the contract.

It frequently occurs that a great deal of tearing down will be necessary before an exact appreciation of the damage can be made, in which case it may pay to engage men by the day to clear away some of the sound portions in the vicinity of the damaged part of the vessel.

Extras should be guarded against as much as possible, for it is by means of these that the contractor often makes all his profit. When extras are likely to turn up it is advisable for a clause to be put into the specification as follows:

"All extras outside a liberal interpretation of this contract to be either charged as extra time and material, or, at the master's option, a supplementary tender is to be made for the extra work disclosed."

Should too drastic a clause be made under this heading, it would mean, unless the trade competition at that port was very keen, that the price tendered in the first place for the repairs would be very excessive.

The time required to do the work is a very important feature in a contract; therefore the following clause is usually inserted: "Time to be the essence of this contract." The time required by the contractor to do the work will be filled in by himself, a space being left for that purpose.

"The lowest tender not necessarily to be accepted" is another important clause, for the contract must be governed as much by the time required to complete the repairs as by the cost of them.

When repairs are of any magnitude it is usual for a certain sum of money to be asked for by the master from the contractor as a Guarantee, the said sum to be lodged in a bank in the name of two trustees. A penalty in the shape of a certain sum per day should be imposed if the contractor does not complete the work in the time he specifies, and a bonus of a certain sum per day promised for each day saved.

The penalty and the bonus are usually reckoned upon the basis of the value of the vessel's time and of her future engagements, if any.

An advertisement should be inserted in some of the leading newspapers to the effect that tenders for the repair work on the "———" are invited, that specifications for the repairs are to be had at the office of the agent of the vessel, and stating the time and date when the tenders are to be opened.

At the time advertised for the tenders to be opened, there should be present at the agent's office, Lloyd's agent (if the vessel is insured at Lloyd's), Lloyd's surveyor, or the surveyor that is acting for the vessel, a representative of the local underwriters if interested, the vessel's agent, and the master.

It is the duty of the agent to open the tenders and to read aloud the tenderers' terms to the party assembled. After all the tenders have been opened, and read, the party assembled will consult together and decide upon the most desirable tender.

The contractor whose tender is accepted will be called in, and the tender will be signed by the party assembled. The contractor signs first, and his signature is followed by that of the master, the ship's agent, Lloyd's surveyor, Lloyd's agent, and the others interested.

A surveyor will be appointed who will supervise the work conjointly with the master (usually the ship's engineer if a steamer, who will be answerable to the master that the work is being done in an efficient manner and that good material is being used). Lloyd's surveyor will call on board the vessel at intervals in order to see that his requirements are being carried out.

After the repairs are executed a survey is held by the master and Lloyd's surveyor (it is assumed that Lloyd's surveyor is acting for the vessel), and the latter prepares a report upon the repairs, handing at least two copies to the master, one of which will go to the owner. Lloyd's surveyor will also, if the repairs are executed to his satisfaction, issue a certificate of sea-worthiness if the repairs are of a temporary nature, or a certificate of classification should the repairs be permanent, and hand it to the master.

The master carefully records the time of receiving this certificate, in the event of it being required at any time.

The certificate of seaworthinesss or classification should be retained on board the vessel in the ship's box.

SUEZ CANAL TONNAGE

Upon arriving at the Suez Canal, either at Port Said or Suez, an official appointed by the Canal Authorities will come on board and satisfy himself that no deck erections, poop, bridge space, or shelter-deck, or any other places not included in the Canal register, are filled with either bunker coal or cargo, or any of the proper bunker space filled with cargo; should any spaces not included in the tonnage be so filled, the ship will have to pay Canal dues for them, not only for that voyage alone, but also for every subsequent passage through the Canal, whether any of the spaces so charged upon before then contain cargo or bunker coal or not.

It sometimes happens that it will pay to remove a small quantity of cargo from any of these spaces to the deck, providing it will not receive damage through the inclemency of the weather, and after passing through the Canal to replace it if necessary.

A ship with a large bridge space that is used for bunker coal should, if that space is not already included in the Suez Canal tonnage, have, if possible, that space free from coal on arriving at Suez and clean swept out. This space may be filled with bunker coal on arriving at Port Said without having to pay dues.

There are certain regulations that apply to a ship with a shelter deck when part of that space only is filled with cargo, and which contains no bunker coal.

The bunkers in this case are estimated to take up that part of the shelter deck that lies between the engine-room and fiddley bulkheads and the ship's side, and is bounded by an imaginary line that crosses the ship at the fore end of the fiddley casing and after end of the engine-room casings respectively.

Should there be any cargo in the shelter deck then the whole of the shelter deck will be measured as tonnage space, with the exception of that in the wake of the engine-room and fiddley casing.

Should the cargo consist only of a few tons, and that cargo not be separated from the rest of the shelter deck by a permanent steel bulk-head, then the whole of the shelter deck, other than that in the *wake* of the engines and boilers described above, will pay dues.

CARRIAGE OF DIFFERENT CARGOES

Copra. When carrying copra care must be taken that it is not stowed in a 'tween deck, where water from it may find its way into the hold below. It is best to stow it, if a small consignment, in a peak or poop; if a large one, then in the lower hold.

Copra gives off a rank acrid smell that will damage any food-product. Many unscrupulous merchants will guarantee that their copra is all sun-dried, and that it will not give off any moisture; but as it is the general practice of many native merchants to wet it well before sending it to their sales merchant, and as it will readily absorb considerable moisture without any appreciable difference being noticeable, it is well to test it, before it has the chance of doing any harm, in the following manner. Weigh a bag carefully, spread the contents in the sun for a few hours, then bag up and weigh again; the amount of moisture in the cargo can then be readily arrived at.

Large consignments of copra are shipped in bulk, small quantities are shipped in bags, which soon rot unless the contents are really sun-dried copra.

Tea. Tea should never be stowed in any hold where kerosene or paraffin oil has been carried, unless the hold has been well fumigated, and on no account should it be stowed where camphor oil has recently been carried; in fact it should, if possible, be kept out of any hold that has contained China or any other kind of oil, otherwise it will become tainted and a claim will surely result. Tea used, until recently, to be protected from the spar ceiling by a lattice work of split bamboos and mats, but the writer has carried it with excellent results where mats only against the spar ceiling have been used.

Gambia. Gambia must never be stowed in a 'tween deck; the juice is more searching than paraffin, and will find its way through a deck that is tight to water. Gambia must not be stowed more than six feet high or the weight of itself will force the juice through the bags and so leak away.

The usual way to stow gambia is to floor off with three to four inches of sawdust and then stow. Between every tier of bags should be placed double mats to prevent the bags sticking together. It must be stowed in a cool place, such as the poop or even in the run of the vessel in the after lower hold. When stowed in the after lower hold the gambia should be built up, say, to the top of the tunnel, and then floored off with stout planks with their ends resting upon a convenient stringer to prevent any weight being laid upon it. In vessels with a long bridge deck the space below it has frequently been used by the writer with the best results, but care must be taken to keep it away from the engine-room and stokehold casings, and to maintain good ventilation in order to keep it at as low a temperature as possible. Gambia is sometimes shipped in cases.

Rattan Canes. Large quantities of rattan canes are shipped from Singapore, some being washed and some unwashed. Both have to be treated and stowed with care or they will deteriorate : therefore they should on no account be used as dunnage. Canes should be stowed somewhere near the top, or say in the 'tween decks and filled up with some light cargo that will not crush or soil them.

Tapioca Flour. Neither tapioca nor tapioca flour should be stowed near or in the same hold as any strong-scented cargo, such as China oil, hides, Japanese curios (which may contain camphor as a preservative), &c., nor should it be stowed in the same hold with pepper which, together with spices, will speedily taint it.

Pepper. Pepper sweats much at times and gives off pungent fumes, if even slightly green. If pepper is stowed in the lower hold it is well to leave a trunkway down through the 'tween deck and have the hatches removed for ventilating purposes at every opportunity, to allow the steam to escape.

Gellutong. Gellutong is packed in cases made of green Borneo wood of poor quality. The cases are frequently full of water when coming on board, as it is the practice to leave it uncovered in the lighters before shipment in order to increase its weight. The writer has frequently had to send large quantities of gellutong back to the shore in Singapore owing to the amount of water that drained from the cases when heaving it up out of the lighters. The shippers contend that as it is not injured, but is on the contrary improved by the water being in the cases, it should be shipped in that condition; little caring that it will damage any cargo stowed in that hold compartment through the sweat that is bound to arise from it when at sea. The cases are invariably quite rotten from the practice of keeping it wet with a hose playing upon it, therefore it is usual to insert the following clause in the bill of lading: "All cooperage to the cases to be paid by the consignee before taking delivery." Gellutong should never be stowed in a warm place, as it then loses weight and the ship will be liable to claims.

Tin. When completing loading from the Philippine Islands with a large quantity of hemp it frequently occurs that provision cannot be made for ground space; but if a well is left in the hatchways, the tin can readily be stowed upon the hemp, taking care that too much weight is not stowed in one place. The writer has frequently stowed large quantities of tin upon hemp, first putting planks between the two substances, and not piling the tin more than five tiers high. It is a common occurrence when loading for the Conferences that a full cargo of hemp is arranged for, but in consequence of a falling market and other causes, the ship is ordered on to Singapore to fill up with what she can get, thus causing great inconvenience. A large quantity of tin is frequently loaded in Penang, which is the last port of loading.

Spices. These must not be stowed with hides, and should be kept as far as possible from pepper; on no account are they to be stowed near tea, or the tea will be contaminated, and a claim will result.

Hemp. As this is one of the most important shipments from the East it will be well to say something about it. It is not customary to employ screws when stowing, as was formerly the case, but only in order to get another bale into a tier. Bales of hemp should stow in 12·5 cubic feet, but as some shippers try to ship larger bales it is well to measure a percentage as a check upon both the shipper and the stevedore. A bale can be rejected, under the Conference rules, if it measures more than thirteen cubic feet, also if two adjacent bands are adrift. It is usual to put mats up the sides and on the floor dunnage. Good ventilation is very necessary with this cargo, as it frequently gives off much moisture, especially during cold weather; therefore, to avoid claims, it is necessary to have the hatches off every day it is possible to do so, in order to give the hot air a chance of escaping from the hold, and not condensing upon the beams and decks. Should condensation occur, the hemp which is stowed close up to the beams and deck will at once turn black, and if mats intervene they seem to accentuate the trouble, as these turn black and stain the hemp they cover.

Camphor. This should be stowed in a peak distant from any other cargo, especially when obtained at the first ports of loading, and it is not known what will be put in the holds at further ports. Camphor oil should also be stowed in a peak by itself, as its smell is most searching and will damage any food-stuffs irreparably.

Japanese Curios. Camphor is sometimes packed with these to keep the moths away; should any smell be detected in them on shipment be careful to stow them as far as possible from, and not in the same compartment as, tea or food-stuffs.

Silks. These should be stowed in the magazine or some safe lock-up place, as pilferage is likely to occur with this class of cargo.

China Oil. The casks the oil is stowed in are usually very old, and third or fourth hand. It is best to stow them in a hold that has had oil in it before, and not contaminate all holds which may be wanted for perishable cargo. It is not advisable to stow more than five casks high if it can be avoided; stow bilge and contline the first three tiers, and then platform off for the two top tiers. When stowing above the oil select cargo that is not too heavy, such as cane, taking care that the cane does not come into contact with the oil-casks. It is quite common for the heads of the casks to be put in the wrong way, and for the head-pieces to be put in athwart instead of up and down with the bung uppermost; these casks should, if possible, be placed in the top tiers.

Never stow China oil or any vegetable oils upon ore; heavy claims have recently been paid upon ore cargoes in consequence of the oil leaking from the barrels upon the ore.

Ore Cargo. A full cargo of ore is apt to strain a vessel unless care is exercised in the stowage of it. Some years ago the writer loaded a cargo of 8700 tons of manganese ore in Vizagapatam for Baltimore, U.S.A. Five-sevenths of the whole was put into the lower holds and the remaining two-sevenths in the 'tween decks in the following manner:

The cargo that was put into the lower hold was allowed to come up to a point, and that point was simply pulled down into the wings, thus leaving the ends of the hold clear of cargo. The 'tween-deck hatches were then put on and covered with loose deals. The ore was kept trimmed back to the bulkheads at each end of the 'tween-decks until it was piled five feet high against them and allowed to slope down to the hatch. The hatch was cleared and the ore trimmed against the sides of the vessel in the wings, sloping down to the hatch.

The 'tween-decks thus had the weight, and the bulkheads transmitted it to the bottom of the vessel, thus equalising the weight fairly well along her entire length.

The ore that lay against the sides of the vessel in the wings lay upon the strongest part of the 'tween-decks, viz., where the deck was supported by the beam knees. The vessel never showed any signs of distress in the least, and though very heavy weather was encountered no straining was experienced.

Case-Oil Cargoes. The modern cargo steamer can take a full cargo of case oil without any ballast; in fact some of the broader type will, in addition, carry a few thousand cases in the bridge and poop. Care must be taken that all the tanks are drained quite dry before the vessel is anything like fully loaded. Should the vessel be found to be tender it is easy to run up a small tank for stiffening purposes.

As said before, it is next to impossible to pump out the tanks of a vessel that is a little tender, for when the vessel takes a slight list all the loose water runs to the low side, thus accentuating that list, and as the suction pipes are situated at some distance from the side of the tank it is impossible to get all the water out.

Case oil is usually loaded under the inspection of an experienced surveyor appointed by the charterer, when loaded in America. After laying the ground tier, one-inch boards are laid over that tier and stowage proceeds as closely as possible; any space where a case will not go is filled up with short cord wood. Every sixth tier is platformed off with boards 6 inches wide and 1 inch thick, two being put on each case so that the thicker ends of the cases shall support the tiers stowed above them.

When taking case oil from any of the refining works it is the custom to allow the oil that has been canned and cased up to lie in the shed twenty-four hours before shipment, so that leaks may be detected and stopped. It is also the custom for the ship's officer tallying, to count the cases composing the blocks in the shed and to see that all go on board the vessel, giving a receipt for each block as it is counted. From time to time leaky cases are found and put on one side; when a truck-load of four is made up they are taken away to be repaired. It is therefore advisable to take a tally of the leaky cases when they go away and also when they come back repaired.

When discharging in the Far East it is the custom for the consignee to have tally clerks to check against the ship. The Custom House also have clerks to check the cargo for revenue purposes. In the case of any dispute between the consignee and the vessel respecting the tally, the Courts in those countries assume that the Custom House tally is correct, but as this is not *always* the case it is advisable to make frequent comparison between the tallies kept by the vessel and by the consignee ; if doubts arise before too much has gone into the lighter a recount of the cargo in the lighter should be made at the expense of the side in the wrong. If this is not done the loss will always fall on the vessel.

It is always advisable to fumigate after a vessel has carried a cargo of case oil in order to get rid of the fumes that will be a menace to perishable cargoes ; and, in addition, to keep the hatches off as much as possible to let the fresh air in.

Coal. If a vessel loads her end hatches before her middle ones she is bound to spring to an extent that varies with the length and strength of the vessel.

A vessel has been known to spring four and five inches, so that when loading a cargo in a dock where the ship lies steady it is usual for a vessel that is loaded at the ends first, to carry an inch or two better than ordinary, as the Plimsoll mark is the limit mark taken by the Board of Trade officers.

When loading such a cargo as the above, it is easy, by means of the formulæ given on pp. 21–29, to calculate what quantity to put into each hatch long before the ship reaches her loaded marks, thus saving a lot of time in shifting the vessel about under the coal-tips.

Sugar. Java sugar is packed in large bucket-shaped baskets which are very cleverly rolled in when completing a tier, so that excellent stowage is made; as these baskets weigh about six hundredweight each it speaks well for the stevedores. A ship full of Java sugar will be down to her summer marks; therefore good stowage must be made. Sugar from the Philippine Islands is packed in soft mats bound with cane; each mat contains about one hundredweight. Care should be taken to have it stowed carefully in tiers across the ship and not to have any slings emptied in the hatchway that cannot be at once put into the tiers. The ship should be well matted and dunnaged before taking in sugar, and, when discharging, all loose sugar should be gathered up from each tier and not allowed to percolate down to the bottom of the hold. Should any loose sugar find its way to the ceiling of the hold it will be treated by the consignee as sweepings, upon which only half freight is paid. When taking in a sugar cargo be careful that no rain reaches it or it will crystallise.

Vessels that are Insulated for Frozen Meat. Vessels that are insulated should never receive or discharge cargo during rain, no matter whether the cargo is liable to damage or not; constant friction takes place between the master on one side, who knows that the insulation will be affected and that he will one day have to account for the bad state of the insulation when extensive repairs have to be effected, and the agent or stevedore on the other, who must have the ship loaded or discharged by a certain date, little caring what damage they may do as long as they are able to show results.

The writer has found a few bundles of straw, thickly strewed in the square of a hatch, will absorb much water, and can readily be removed when the work is finished ; to cover the square of the hatch with tarpaulins is only spreading the trouble, for when the tarpaulins are taken up the water runs off at the sides.

Copies of the regulations for the carriage of frozen produce are supplied every ship in the trade by the insurance or the refrigerating superintendent; therefore there is no need for referring to the subject more fully. It has been the custom in some ports for the stevedores to place the 3 in. by 3 in. battens as they stow the meat; this should be sternly discountenanced, and no battens nailed down should be disturbed. Skids should be used for placing on the battens, and for providing a run for the labourers.

Maize. Maize, because of a late or wet harvest, is sometimes shipped in a green condition, and when so shipped it always heats in the vessel and becomes mouldy. When taking in maize it should be carefully tested to see that the heart is hard. The writer some time ago had an experience, at a French port, of maize that had been shipped green; on taking the case to Court the consignees won because the "tunnel was not lined with wood," although the maize in all the other holds was in a similar or worse condition than that in the after holds.

It is, therefore, best to be on the right side, and, if in doubt as to its fitness, add this clause to the bill of lading: "Not responsible for the effect of any greenness of the maize." Should the shippers not allow this, then make a protest at the consulate, prepare your own bills of lading, sign them, and give them to the shippers.

Bombay Cargoes. When loading in Bombay it is usual to ship a quantity of coir bundles as dunnage; when shipped as such, a huge quantity can be used up at the back of the spar ceilings in the holds without much risk of it being damaged by sweat. As the cargoes are all calculated by measurement, it is better to take goods which pay only a small freight than to leave without every cranny being filled. Also, if loading on the berth, it is usual for each shipper to have the option to ship a certain percentage of seed cargoes in small bags, called pockets, as only half freight is paid upon them—they are useful for broken stowage. Care must be taken to check these quantities, or more may be sent on board than the shipping order warrants and so make the ship lose freight. The writer has found that bales of the hard pressed Indian cotton, sandwiched in with the seeds, make the best and closest stowage—two tiers of bags and one of bales.

Hides. It sometimes happens that hides are put on board that are imperfectly cured; do not have them, or there will be trouble at the port of destination.

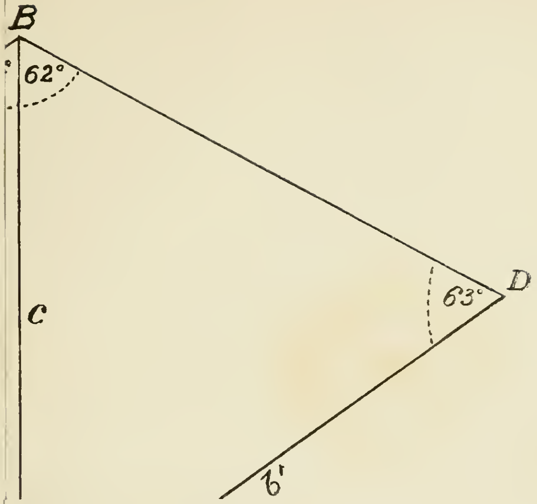
Fruit Cargoes from the Mediterranean. When loading fruit from the Mediterranean to the United States, take more than ordinary care that the scuppers from the 'tween decks to the bilges are clear, for the fruit sweats very badly, and buckets of water can be and should be baled out each morning. Trunkways are usually left from the hatch to the side of the ship to allow the vapour to escape out of the hatch. Booby hatches are usually constructed over the end hatches in each hold to allow of two hatches proper being kept off during the voyage, except during the heaviest weather. Should the ship have steel decks it is usual to sheath them with one-inch wood resting upon 3-inch battens; all the regular traders have wooden decks, and booby hatches fitted to each hatch. As wood has to be imported into Italy, and is dutiable, it would be well, if chartered to carry fruit, to find the exact requirements and have the fittings put up before leaving the home port.

STRAINS UPON DERRICKS AND SPANS

When discharging heavy weights it is frequently a matter of conjecture alone, upon the stevedore's part, as to what strains are put upon the derrick and span while hoisting the weight out of the hold, and lowering it and the head of the derrick over the side of the vessel that the weight may plumb a lighter or railway waggon.

Perhaps when hoisting the weight out of the hold the strain may be equally distributed between the derrick and the span; but when the head of the derrick is lowered so that the weight suspended from it may plumb some particular spot for landing purposes, abnormal strains may possibly be set up in some particular direction. By means of the following short formulæ any strain may readily be found, so that, if desired, another plan may be resorted to which would distribute the strains equally during the whole operation of hoisting the weight from the hold and of lowering the derrick head so that the weight may land on a particular spot.

It is customary for weights up to about five tons to be discharged with the ordinary derricks that have been tested up to five tons, in the following manner: Rig a good preventer span, lead the fall through a single block that is attached to the weight to be lifted, and make fast the standing part of the fall to the derrick head. Take the hauling part through a single block lashed to the side of the derrick head, through another single block at the mast head and then down to the winch on deck. With the above-mentioned method of rigging gear it will still be necessary to find what strains will be set up on the span and the derrick, for it can be readily seen from Fig. 5 that everything will depend upon the dimensions of the angle between the span and the derrick itself.


B
62°
c
D
63°
b'

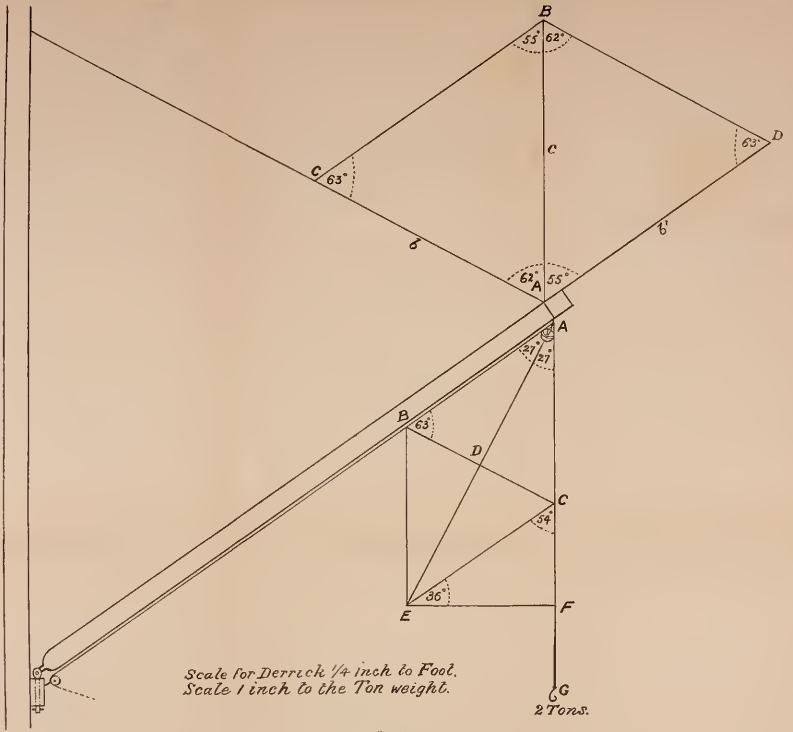

B
55°
62°
C
63°
c
D
63°
b
b'
62°
A
55°
A
27°
27°
B
63°
D
C
54°
36°
E
F
G
2 Tons.
Scale for Derrick 1/4 inch to Foot.
Scale 1 inch to the Ton weight.

Fig. 5.

How to find the Strains by Construction and Calculation.

Find the angle A at the gin on the derrick between the rope that suspends the weight and the part that goes to the heel of the derrick and thence to the winch.

Measure off on a suitable scale A B and A C, say 1 ton to 1 in.

Bisect the angle B A C and connect B C through D.

On the line A D at the distance of twice A D find E.

Connect B E and C E.

At F draw a line at right angles to A G that will meet E.

The distance A E is the strain on the neck of the gin block.

And A F is the total downward strain upon the derrick head.

To find A F = weight on derrick head and span.

Because E C is the opposite side of the parallelogram A B E C to A B, the angle E C F will be equal to B A C, *viz.*, 54°.

C F = Hyp. Sin. ∠ C E F, and
C F + A C = A F.

Hyp. = 2	log.	·30103	
∠ CEF = 36°	Sin.	9·76922	
	log.	10·07025	= C F = 1·176
			A C = 2
Weight on derrick head			A F = 3·176 Tons.

To find A E = weight on the gin block.

A D = Hyp. Sin. ∠ A B D. As A D is half the diagonal of the parallelogram A B E C, A D + D E = weight on gin block.

Hyp. A C = 2	log.	·30103	
∠ ABD = 63°	Sin.	9·94988	
	log.	10·25091	= A D = 1·782
			D E = 1·782
Weight on gin			= A E = 3·564 Tons.

To find the weight on Derrick Span and Derrick. At the point A where the span is shackled to the derrick draw a line parallel and equal to A F to B.

At B draw B C parallel to the upper side of derrick to the derrick span, and B D parallel to the derrick span, to the point D and extend the line of derrick, thus making a parallelogram.

Find the angles with a protractor.

Weight on Span.

$$\text{Side } b = \frac{c \text{ Sin. B}}{\text{Sin. C}}$$

$$\begin{array}{llllr}
\text{Side} & c & = 3{\cdot}176 & \text{log.} & {\cdot}50188 \\
\angle & \text{ABC} = & 55^\circ & \text{Sin.} & \underline{9{\cdot}91337} \\
 & & & & 10{\cdot}41525 \\
\angle & \text{ACB} = & 63^\circ & \text{Sin.} & \underline{9{\cdot}94988} \\
 & & & & {\cdot}46536 = \underline{2{\cdot}92 \text{ Tons.}}
\end{array}$$

Weight on Derrick and Thrust upon Gooseneck.

$$\text{Side } bi = \frac{c \text{ Sin. B}}{\text{Sin. D}}$$

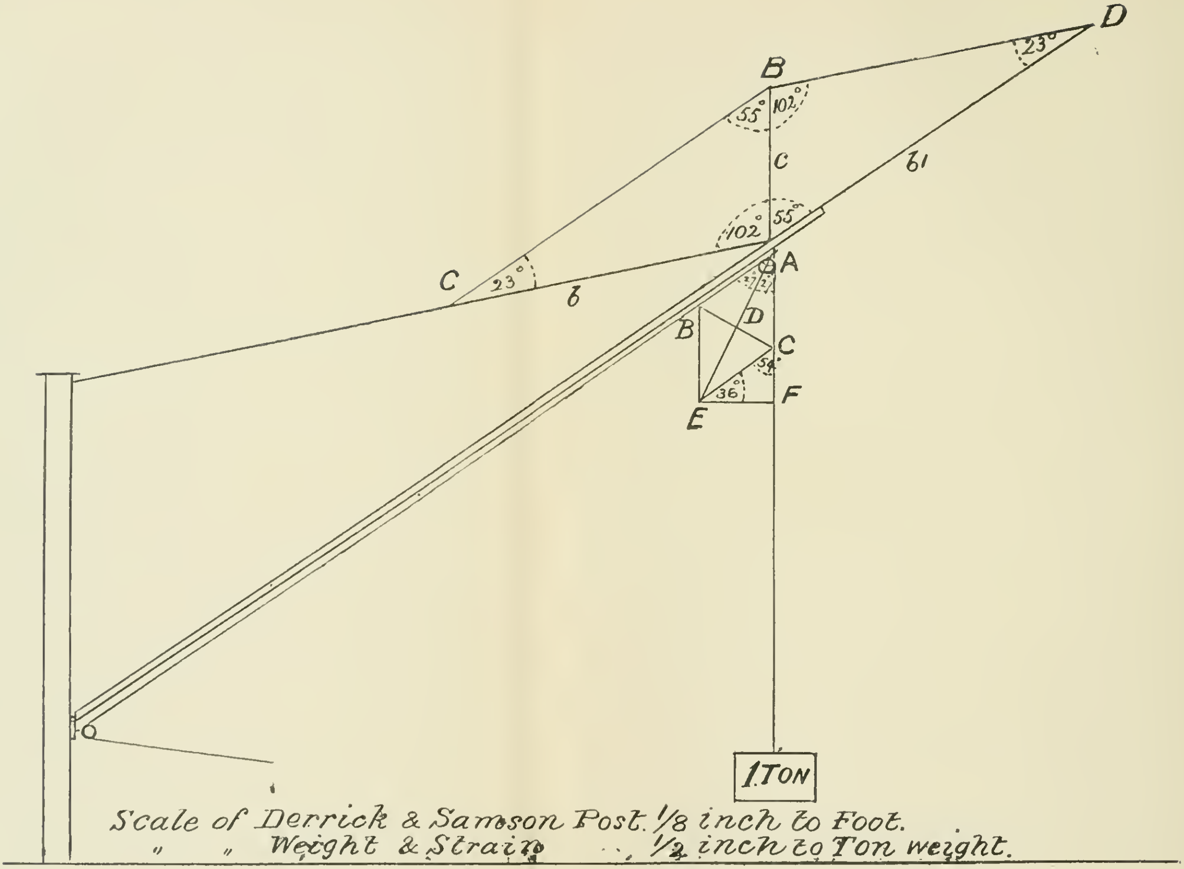
$$\begin{array}{llllr}
\text{Side} & c & = 3{\cdot}176 & \text{log.} & {\cdot}50188 \\
\angle & \text{ABD} = & 62^\circ & \text{Sin.} & \underline{9{\cdot}94594} \\
 & & & & 10{\cdot}44782 \\
\angle & \text{ADB} = & 63^\circ & \text{Sin.} & \underline{9{\cdot}94988} \\
 & & & & {\cdot}49793 = \underline{3{\cdot}147 \text{ Tons.}}
\end{array}$$

A graphic method may be used for this calculation by means of a pair of dividers to bisect the first angle at the gin block and a foot-rule divided to sixteenths; these are all the instruments required.

Make use of a suitable scale, say 1 inch to the ton lifted, and by measurements fairly accurate results can be obtained.

It will be at once seen that the foregoing is a very good lifting appliance, as both the span and the derrick take a fair share and divide the strain very equally between them.

Some lifting appliances are faultily constructed, especially derricks that are attached to samson posts too short to give a sufficient angle between the span and the derrick. Such an appliance will put an abnormal strain upon the span, as well as a tremendous thrust upon the derrick, which in turn communicates it to the gooseneck (usually a very weak spot). Figs. 6 and 7 exemplify some cases, and also demonstrate the fundamental principles upon which a derrick and its gear are based; they indicate how bad cases can be readily recognised, and how the strains in suspicious cases can be calculated, and safeguard such appliances from being overloaded by a too zealous stevedore.



Scale of Derrick & Samson Post 1/8 inch to Foot.
" " Weight & Strain " 1/2 inch to Ton weight.

NOTE:- A BAD CASE.

Fig. 6.

Builders' loading appliances must at times be taken *cum grano salis* until calculation shows them to be safe. Fig. 5 represents a weight of two tons being lifted by a derrick that possesses a fairly large angle between the span and the derrick itself, and is consequently a very good lifting appliance, as the weight is very equally distributed between all parts.

Calculation for Fig. 6.

To find the Weight upon Derrick and Span.

Hyp. CE = ·5 Log. 9·69897
∠ CEF = 36° Sin. 9·76922
Log. 9·46819 = CF = ·29
AC = ·5
AF = ·79 × 2 = 1·58 Tons.

To find the Weight on Neck of Gin Block.

Hyp. AC = ·5 Log. 9·69897
∠ ABD = 63° Sin. 9·94988
Log. 9·64885 = AD = ·45
DE = ·45
AE = ·9 inch. × 2 = 1·8 Tons.

To find Weight on Span.

$$\text{Weight on span, Side } b = \frac{c \text{ Sin. B}}{\text{Sin. C}}$$

Side c = ·79	Log.	9·89763
∠ ABC = 55°	Sin.	9·91337
		9·81100
∠ ACB = 23°	Sin.	9·59188
	Log.	·21912 = 1·66 inch.
		2
		3·32 Tons on span.

To find the Weight on Derrick and Thrust upon Gooseneck.

$$\text{Side } bi = \frac{c \text{ Sin. B}}{\text{Sin. D}}$$

Side c = ·79	Log.	9·89763
∠ ABD = 102°	Sin.	9·99040
		9·88803
∠ ADB = 23°	Sin.	9·59188
	Log.	·29615 = 1·98 inch.
		2
		3·96 Tons on derrick.

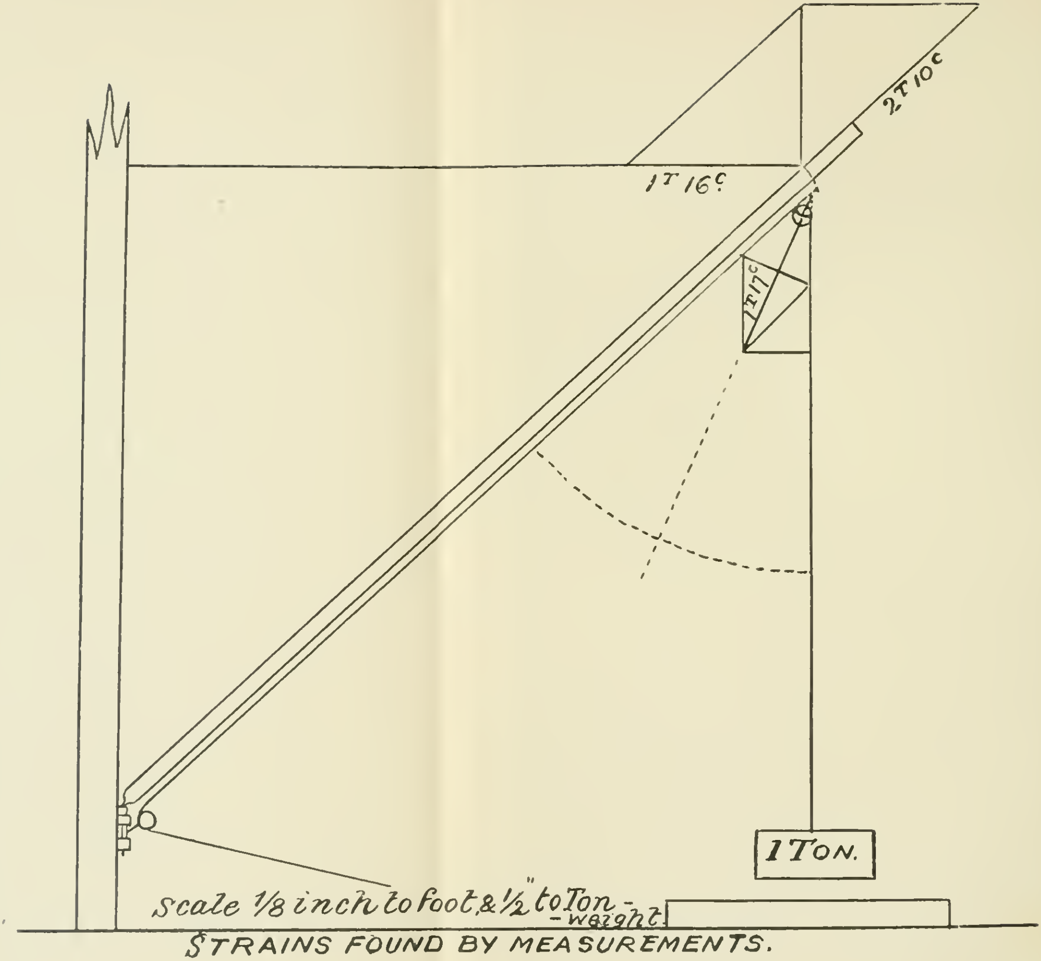

$2^{T}\,10^{c}$
$1^{T}\,16^{c}$
$1^{T}\,17^{c}$
1 TON.
scale 1/8 inch to foot & 1/2" to Ton-weight
STRAINS FOUND BY MEASUREMENTS.

Fig. 7.

It will at once be seen from Fig. 6 that it is one of many bad cargo working appliances that are so often seen on board cargo steamers. By reason of the angle at the derrick head contained by the span and the derrick being of such small dimensions, abnormal strains and stresses are set up out of all proportion to the weight that is being lifted.

Fig. 7 represents a very fair working appliance, and one that is usually fitted upon the modern cargo steamer that is fitted with short telescopic masts. It will be seen from the figure that the span is at right angles to the mast, with the head of the derrick at the same height above the deck as the lower masthead—a very common occurrence.

Method of rigging a Heavy-lift Derrick. Many modern cargo vessels are fitted out with a heavy-lift derrick, fitted with a cup and ball at its heel, and when not in use, the derrick is securely clamped to the mast. Many vessels have a heavy derrick supplied on board, which, when not in use, is lashed down to the deck in some convenient position. Such derricks are usually fitted with heavy steel bands that have eyes and link attachments suitable for taking the span tackle, purchase tackle, and also the guy tackles. They also have the heel fitted tightly into a socket, which socket terminates with a ball; all these arrangements are part and parcel of the derrick itself, and cannot be separated from it. The ball at the heel of the derrick fits into a cup, which cup is usually securely attached by means of bolts to a large wooden shoe of sufficient dimensions to take over at least three deck beams.

It occasionally happens that such a complete derrick cannot be obtained at short notice, and a heavy spar only is supplied on board; it would, therefore, be necessary to fit this spar with a suitable shoe, and also with large cleats, that are secured to the derrick by means of heavy wood screws to prevent the lashings at the head from slipping.

The blocks required to put out, say, a twenty-ton lift, will consist of one pair of 12-inch threefold steel blocks for the span tackle; one pair of 12-inch threefold steel blocks for the main purchase, both of which must be of ample strength, and fitted either with large eyes or large shackles suitable to take the lashings; three 12-inch single blocks for the hauling parts of both tackles aloft, and with two pairs of double 8-inch blocks for the guy tackles.

Where Manila rope is to be used for the guy tackles the writer recommends that the guy tackles should each consist of a treble and a double 10-inch block, and the falls of 4-inch Manila rope.

Two coils of 2½-inch, or 2¾-inch flexible steel wire, each about 120 fathoms in length, according to the length of the derrick and the depth of the hold, will also be required.

Two coils of 2-inch flexible steel wire rope of suitable length are to be preferred for guy-tackle falls, especially when handling weights in cold damp climates where Manila rope is so liable to put turns into the guy tackles.

The tackles should be rove off before lashing the blocks in their places, but this is merely a matter of opinion.

The span-tackle block that has the hauling part should first be secured to the head of the derrick with a slack wire rope or Manila round lashing, that all parts may render when the weight comes upon them; after passing sufficient turns through the eye of the block take a turn or two with both the ends of the lashing round the derrick only, knot the ends together, and stop them back.

Next lash the block of the main purchase that has not the hauling part over the top of the preceding lashing with a similar slack lashing, first parcelling the under lashing to prevent it being cut.

Next, lash the blocks of the guy tackles that have the hauling parts.

Lastly, lash one of the before-mentioned single blocks at the side of the head of the derrick and through it lead the hauling part of the main purchase.

The blocks at the head of the derrick are now complete.

Lash the block of the span tackle that does not have the hauling part to the mast above the top with a slack round lashing, taking a few turns round the mast with the ends, knotting them together and stopping them back.

Immediately above the preceding lashing, lash one of the before-mentioned single blocks and through it lead the hauling part of the span tackle and carry the same on deck as far forward as possible (it being assumed that the heavy lift is down the main hatch), where it should, after the derrick is in position, be led along and secured to the bitts ready for slacking away if necessary.

Another of the before-mentioned single blocks will be lashed to the mast as high up on the lower mast as possible, and through it will be led the hauling part of the main purchase. The block of the main purchase tackle that contains the hauling part being down the hold, the hauling part will be led through a block at the head of the derrick, and then through the highest block of all on the mast down to the winch, or windlass, as the case may be.

The block containing the hauling part of the span tackle will be lashed to the head of the derrick, the hauling part taken through a single block that is lashed to the mast, and then led down on deck.

The shoe for the heel of the derrick to rest in must be placed in position, and no place lends itself so fitly as that at the foot of the mast. It should be seen that the shoe rests upon at least three beams, and these beams should be shored up from the deck below.

It is vitally necessary to have the mast securely stayed. To this end heavy wire preventer stays should be fitted upon the opposite side of the mast to that on which the weight is being lifted, carried well forward, and, after being set up to carry a little more weight than the permanent stays, secured. It is also advisable to have the opposite side of the mast to that on which the weight will be lowered over the side of the vessel securely stayed, otherwise a heavy strain will be thrown upon the backstays if the derrick is lowered to plumb over the rail.

Should the derrick be short for its work when the weight has to be lowered over the side of the vessel, it may be advisable to place the heel shoe a little distance from the centre line of the vessel; should this course be resorted to, be very careful that the heel is well secured by good wire-rope lashings and shores to prevent it sliding along the deck, and that an extra good shore-guy tackle is made use of, as a great strain will necessarily come on this guy when hoisting from or lowering down the hold.

A derrick of the proper length should, when its heel is secured at the foot of the mast, be long enough to plumb ten feet outside the vessel's rail when at an angle with the mast of not more than 50°.

A heavy-lift derrick should, like all other derricks, have much greater thickness in the middle than at the ends; the writer has, in the absence of this thickness, lashed a spar along the middle of the heavy-lift derrick, thus strengthening it considerably.

The weight that will be taken up by the span tackle and the derrick itself can easily be calculated by the preceding formulæ.

As the hauling part of the main-purchase tackle is carried up aloft it is apparent that, during the action of lifting the weight out of the hatch, no more weight will come upon the derrick than when it is being lowered down.

From the figure it will be seen that if the span tackle was secured higher up the mast, thus increasing the angle between the span tackle and the derrick, more weight would be taken by the span tackle and less weight by the derrick itself, thus distributing the weight better; but, as most modern steamers are fitted with short stumpy masts, while their beam is of considerable dimensions, it follows that the derrick must be of considerable length to enable it to plumb over the vessel's rail, while the lashing cannot be carried up very high, thus making it impossible to obtain the best distribution of the strains that are set up.

To find strain on Span. Fig. 8.

$$\text{Side } b = \frac{C \text{ Sin. } B}{\text{Sin. } C}$$

$$\begin{array}{llll}
\text{Side } C & = 20 & \text{Log.} & 1{\cdot}30103 \\
\angle\ ABC & = 45^\circ & \text{Sin.} & \underline{9{\cdot}84949} \\
 & & & 11{\cdot}15052 \\
\angle\ ACB & = 55^\circ & \text{Sin.} & \underline{9{\cdot}91337} \\
 & & \text{Log.} & \underline{2{\cdot}23715} = \underline{17{\cdot}26} \text{ Tons upon span.}
\end{array}$$

To find strain on Derrick.

$$\text{Side } bi = \frac{C \text{ Sin. } B}{\text{Sin. } D}$$

$$\begin{array}{llll}
\text{Side } C & = 20 & \text{Log.} & 1{\cdot}30103 \\
\angle\ ABD & = 80^\circ & \text{Sin.} & \underline{9{\cdot}99335} \\
 & & & 11{\cdot}29438 \\
\angle\ ADB & = 55^\circ & \text{Sin.} & \underline{9{\cdot}91337} \\
 & & \text{Log.} & \underline{2{\cdot}38101} = \underline{24{\cdot}05} \text{ Tons upon derrick.}
\end{array}$$

Strains upon Tackles. An important

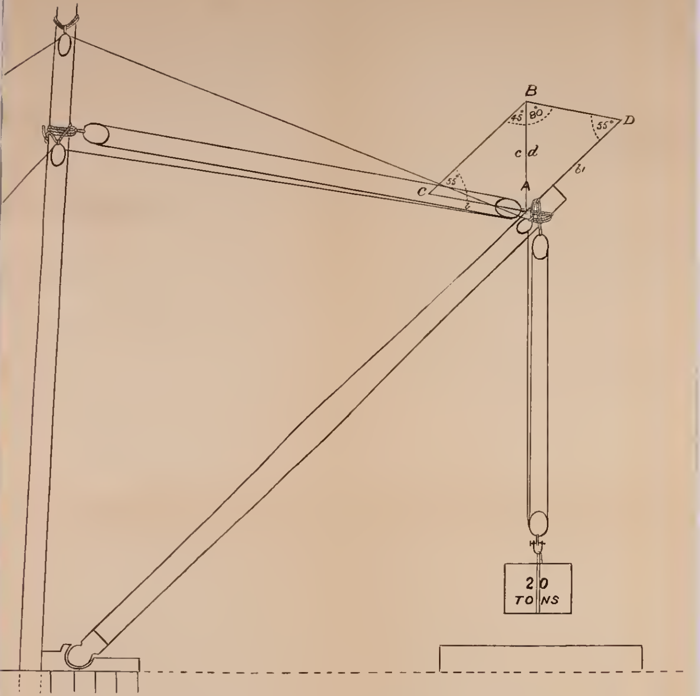
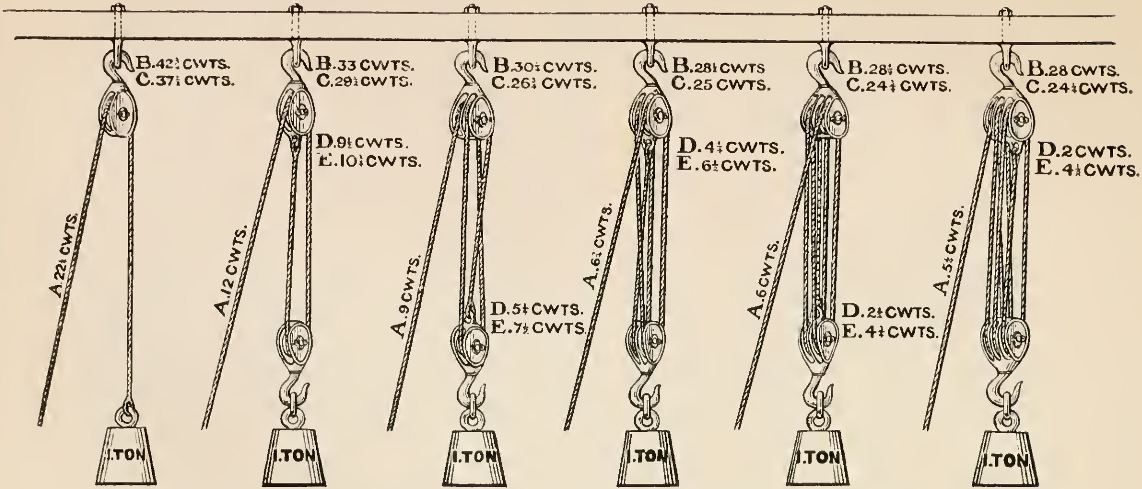


Fig. 8. Both the Span purchase and the Main purchase are composed of threefold blocks, but for the purpose of keeping the figure clear in order to show the disposition of the hauling parts, also the parallelogram, a side elevation only is shown and the securing of the standing part of the tackles omitted.

Fig. 9.

Showing by illustrations the approximate relative lifting power, &c., of various combinations of sheaves and the stress on different parts of the pulleys.



A, power required to raise load. B, strain ontop hook raising load. C, strain on top hook when lowering load. D, strain on becket raising load. E, strain on becket when lowering load. Copyright by Davey and Co., Ltd , London.

element that enters into the calculation of strains set up on derricks when lifting heavy weights is the amount of strain that has to be put upon the hauling part of the tackle fall to overcome the friction of the sheaves upon the central pin, also that due to the bending of the fall over the sheaves. The strains due to friction and bending of the fall is over and above the strain that is theoretically necessary to lift the weight.

Several experiments have recently been made in order to find the extra strains due to friction, &c., by Messrs. Davey and Co., Ltd., London, who have favoured the writer with their valuable illustration, Fig. 9.

It will at once be observed that if a derrick and tackle is used to lift any heavy weight it would reduce the strain upon the derrick and upper block, if the block with the hauling part was placed next to the weight to be lifted as in Fig. 8.

The hauling part should then be taken through a single block at the derrick head, through another single block that is secured as high as possible on the mast, and then down to the winch on deck.

INDEX

A

A.A. form, 7, 40
Advertisements, 77, 78
Advices to mariners, 7
Anchors and chains certificate, 1
Articles, 1, 3, 6, 10
Average adjuster, 71
  bond, 74, 75
  contribution, 68, 70
  general, 67, 69
  particular, 66, 67

B

B.B. form, 6
Bilges, inspection of, 37, 39
  sounding of, 43, 45
Bills of health, 5, 7–10, 41, 42
  lading, 41, 46–54, 97
Boats and lights certificate, 1
Boiler certificate, 1
Bombay cargoes, 97
Bonded stores list, 1
Booby hatches, 98

C

CABLEGRAMS, 13, 14, 73
Camphor, 88
Cargo, 70, 71
Charter-party, 2, 54
Charts, catalogue of, 2
Classification certificate, 1, 79
Clearance, consular, 42
  from last port, 5, 7, 8, 41, 42
  not necessary, 8
Coal, 93
Co-efficient of fineness, 30
Collision, 40
Colours, showing of, 17, 18
Compass observation book, 2
Copra, 82
Crew, 6, 7
Crew list, 42
Crew's wages, 68
Custom House entry, 5, 6, 42

D

DATE, cancelling, 62, 63
  lay-days commence, 61
  of shipment, 50
Deck cargo, 68
Demurrage, 47, 58, 60, 65
Derrick, heavy-lift, 107–114
  strains upon, 99–114
Dispatch money, 56, 57
Drafts, computation of, 21–29
Dunnage, 37, 38, 96

E

EXTRAS to specifications, 76

F

FIRE damage, 68, 70
Freight, 47, 51, 52, 60
Frozen produce, surveys of, 19, 20
Fruit cargoes, 98
Fumigation, 93
  certificate, 11, 43

G

GAMBIA, carriage of, 83
Gellutong, 85
Gravity, centre of, 21
Guarantees, 77

H

HARTER Act, 46, 47
Heavy lifts, 100, 107–114
Hemp, stowage of, 87, 88
Hides, 98

I

ICE clause, 47
Indicated horse-power, 31
Insulation for frozen produce, 96, 97

J

JAPANESE curios, 88
Jerque note, 7, 40

L

LAY-DAYS, 55, 56, 61–63
Letters of indemnity, 52–54
Lien on cargo, 47, 69
Light bill, 1, 5
Lighterage clause, 47
Loading, 40
Load-line certificate, 1
Log-book entries, 39, 40, 50
Lookout, 29

M

MAIZE, 96
Manifest of cargo, 5, 40–42
  of dutiable stores, 4, 5, 42
Mate's receipts, 50
Metacentre, longitudinal, 23–30

N

NAVIGATION instruments, 2
Negligence clause, 46, 47
Notice of readiness, 58, 59

O

OFFICIAL log-book, 1, 3, 6
Oil, case, 91–93
  china, 85, 89, 90
Ore cargo, 90

P

PASSENGERS' luggage, 69
Pepper, 85
Pilots, 16
Port officials, 14, 15
Pratique, 4, 5, 42
Protest, extended, 70
  extending, 11, 12, 71
  noting of, 2, 11, 65, 97

R

RATTAN canes, 84
Register, 1, 3, 5, 10, 40
Repairs, 72, 75–79

S

SAILING directions, 2
Seaworthiness, certificate of, 79
Ship's papers, 1–6, 40–43
Silks, 89
Specifications, 71, 75
Spices, 87
Stability of vessel, 34–36
Strains on cargo gear, 99–114
Stranding, 39
Store lists, 2
Suez Canal certificate, 1
  tonnage, 80–82
Sugar, 94
Survey reports, 69–70
Surveys required, 18, 19, 20, 79

T

TALLY clerks, 92
Tanks, filling of, 34–36
  sounding of, 43–45
Tapioca, 85
Tea, 83
Tenders, 77, 78

Tin, 86
Tonnage certificate, U.S.A., 10
Towage clause, 47
Travelling bill, 7

V

VALUES of cargo, 73, 74
  freight, 73
  vessel, 73
Ventilation of cargo, 39, 84, 85, 88
Vessel, after being pierced, 32, 33
Victualling bill, 41
Vouchers, 70

W

WAGES accounts, 2, 7
Water ballast, 33, 39
Wetted surface, 31

Z

ZERO, from which to measure distances, 24, 25

PRINTED BY
BALLANTYNE & COMPANY LTD
AT THE BALLANTYNE PRESS
TAVISTOCK STREET COVENT GARDEN
LONDON

CHARLES GRIFFIN & COMPANY,

LIMITED.

A SUMMARISED LIST OF

THE

ENGINEERING, MINING, METALLURGICAL AND TECHNICAL PUBLICATIONS

OF

Charles Griffin & Co., Limited.

QUIS SEPARABIT NOS?

1820

These Publications may be obtained through any Bookseller in the United Kingdom, or will be sent on receipt of a remittance to cover published price and postage. To prevent delay, Orders should be accompanied by a Cheque or Postal Order crossed "Union of London and Smith's Bank, Chancery Lane Branch."

Telephone—
1634 City.

LONDON:

Telegrams—
"Explanatus," London.

12 EXETER STREET, STRAND.

6-1-xiii.

GRIFFIN'S ENGINEERING PUBLICATIONS.

DESIGN OF STRUCTURES (Bridges, Roofs, &c.). By S. ANGLIN, C.E. FIFTH EDITION, Revised. 16s.

THE DESIGN OF BEAMS, GIRDERS, AND COLUMNS in Machines and Structures, with Examples in Graphic Statics. By W. H. ATHERTON. 6s. net.

BRIDGE CONSTRUCTION (Practical Treatise on). By Prof. C. FIDLER, M.Inst.C.E. FOURTH EDITION, Revised. 30s.

CONSTRUCTIONAL STEELWORK. By A. W. FARNSWORTH, A.M.I.C.E. Cloth. 10s. 6d. net.

DOCK ENGINEERING. By BRYSSON CUNNINGHAM. SECOND EDITION. With Folding Plates and other Illustrations. 30s. net.

HARBOUR ENGINEERING. By BRYSSON CUNNINGHAM. In Large 8vo. Cloth. Profusely Illustrated. 16s. net.

HYDROGRAPHIC SURVEYING. By Commander S. MESSUM, R.N. Beautifully Illustrated. 12s. net.

HYDRAULIC POWER AND HYDRAULIC MACHINERY. By Prof. H. ROBINSON, M.Inst.C.E. THIRD EDITION, Revised. 25s. net.

PUMPING MACHINERY (Steam and Water Pressure). By HENRY DAVEY, M.Inst.C.E. SECOND EDITION. 21s. net.

MODERN PUMPING AND HYDRAULIC MACHINERY. By EDWARD BUTLER. Profusely Illustrated.

WATER SUPPLY: Selection of Sources and Distribution. By R. E. MIDDLETON, M.Inst.C.E., &c. With Plates and other Illustrations. 8s. 6d. net.

SEA WATER DISTILLATION. By FRANK NORMANDY. 6s. net.

THE THEORY OF THE STEAM TURBINE. By ALEX. JUDE. SECOND EDITION. 18s. net.

GAS, OIL, AND AIR ENGINES. By BRYAN DONKIN. Revision by H. GRAVES SMITH and Prof. BURSTALL. FIFTH EDITION. Revised and Enlarged. 25s. net.

EVOLUTION OF THE INTERNAL COMBUSTION ENGINE. By EDWARD BUTLER. Very fully Illustrated. 8s. 6d. net.

INTERNAL COMBUSTION ENGINES. By C. W. ASKLING and E. ROESLER, M.E. 12s. 6d. net.

THE GAS TURBINE. By H. H. SUPLEE, B.Sc. In Handsome Cloth. 12s. 6d. net.

THE GAS TURBINE (Results from Two Actual Machines). By HOLZWARTH and CHALKLEY. 7s. 6d. net.

SUCTION GAS PLANTS. By Prof. C. A. SMITH. Fully Illustrated. 5s. net.

OIL MOTORS: Their Development, Construction, and Management. By G. LIECKFELD. In Handsome Cloth. Fully Illustrated. 15s. net.

STEAM BOILERS—Land, Marine, and Locomotive (The Heat Efficiency of). By BRYAN DONKIN. 25s.

BOILERS, LAND AND MARINE. By T. W. TRAILL, M.Inst.C.E. FOURTH ED 12s. 6d.

STEAM BOILERS: Their Defects, Management, and Construction. By R. D. MUNRO. FOURTH EDITION. 4s. 6d.

SMOKE ABATEMENT. By WM. NICHOLSON, Chief Smoke Inspector to the Sheffield Corporation. With 59 Illustrations. 6s. net.

LUBRICATION AND LUBRICANTS. By L. ARCHBUTT and R. M. DEELEY. THIRD EDITION, Thoroughly Revised. 25s. net.

EMERY GRINDING MACHINERY. By R. B. HODGSON, A.M.Inst.C.E. Fully Illustrated. 5s. net.

INVESTIGATIONS ON THE POWER REQUIRED IN ROLLING MILLS. By J. PUPPE. 12s. 6d. net.

LOCOMOTIVE ENGINEERING. By W. F. PETTIGREW, M.Inst.C.E. THIRD EDITION, Revised throughout. New Illustrations. 21s.

LOCOMOTIVE COMPOUNDING AND SUPERHEATING. By J. F. GAIRNS. 8s. 6d.

LIGHT RAILWAYS at Home and Abroad. By W. H. COLE, M.Inst.C.E. Handsome Cloth. 16s.

MECHANICAL ENGINEER'S REFERENCE BOOK. By H. H. SUPLEE, B.Sc. THIRD EDITION. 18s. net.

PRACTICAL CALCULATIONS FOR ENGINEERS. By C. E. LARARD, A.M.Inst.C.E., &c., and H. A. GOLDING, A.M.Inst.M.E. SECOND EDITION. 6s. net.

MECHANICAL DRAWING. By J. E. JAGGER, M.Sc. 10s. 6d. net.

MECHANICAL ENGINEERING FOR BEGINNERS. By R. S. MCLAREN. Cloth. With 126 Illustrations. SECOND EDITION. 5s. net.

BONUS TABLES: for the calculation of Wages on the Bonus System. By H. A. GOLDING, A.M.Inst.M.E. 7s. 6d. net.

THE CALCULUS FOR ENGINEERS AND PHYSICISTS. By Prof. R. H. SMITH, A.M.Inst.C.E., &c. SECOND EDITION. 7s. 6d. net.

MEASUREMENT CONVERSIONS (English and French). 43 Graphic Tables or Diagrams on 28 Plates. By Prof. R. H. SMITH, A.M.Inst.C.E., &c. 7s. 6d.

THE EFFECTS OF ERRORS IN SURVEYING. By HY. BRIGGS, M.Sc. In Crown 8vo. Cloth. 5s. net.

ELEMENTARY GRAPHIC STATICS. By W. J. CRAWFORD, D.Sc. 2s. 6d. net.

CALCULATIONS ON THE ENTROPY-TEMPERATURE CHART. By W. J. CRAWFORD, D.Sc. 2s. 6d. net.

VALVES AND VALVE GEARING. By CHARLES HURST. SIXTH EDITION, Revised and Enlarged. 9s. net.

THE THERMO-DYNAMIC PRINCIPLES OF ENGINE DESIGN. By LIONEL M. HOBBS, Eng.-Lieut., R.N. 4s. 6d. net.

ENGINEERING DRAWING AND DESIGN. By S. H. Wells, Wh.Sc., &c. Fifth Edition. Vol. I.—Practical Geometry, Plane, and Solid. 4s. 6d. Vol. II.—Machine and Engine Drawing and Design. 4s. 6d.

CIVIL ENGINEERING PRACTICE. By F. Noel Taylor. With 1,086 Illustrations. 25s. net.

THE MAIN DRAINAGE OF TOWNS. By F. Noel Taylor. Fully Illustrated. 12s. 6d. net.

MODERN DESTRUCTOR PRACTICE. By W. F. Goodrich. Fully Illustrated. 15s. net.

ROAD MAKING AND MAINTENANCE. By Thomas Aitken. Second Edition. With important new matter on Dust Prevention. Very fully Illustrated. 21s. net.

MODERN ROAD CONSTRUCTION. By Francis Wood, M.Inst.C.E. Pp. i-xi + 137. 4s. 6d. net.

DUSTLESS ROADS: TAR-MACADAM. By J. Walker Smith, City Engineer, Edinburgh. Large 8vo. 10s. 6d. net.

PETROL MOTORS AND MOTOR CARS. Comprising the Designing, Construction, and Working of Petrol Motors. By F. Strickland. Fully Illustrated. 18s. net.

MOTOR CAR MECHANISM AND MANAGEMENT. By W. P. Adams. Part I.—The Petrol Car. Third Edition. 5s. net. Part II.—Electrical Cars. 5s. net.

CARBURETTORS, VAPORISERS, AND DISTRIBUTING VALVES. By Ed. Butler, 6s. net.

COMPENDIUM OF AVIATION. By Lieut.-Col. Hoernes. Pocket Size. 2s. 6d. net.

THE PROBLEM OF FLIGHT. By Prof. H. Chatley, B.Sc. Very fully Illustrated. Second Edition, Revised. 10s. 6d. net.

THE FORCE OF THE WIND. By Prof. Herbert Chatley, B.Sc. In Crown 8vo. Cloth. Illustrated. 3s. net.

STRESSES IN MASONRY. By Prof. Herbert Chatley, B.Sc. In Crown 8vo. Cloth. Fully Illustrated. 3s. 6d. net.

BUILDING CONSTRUCTION IN EARTHQUAKE COUNTRIES. By Ing. A. Montel. 8s. 6d. net.

CENTRAL ELECTRICAL STATIONS (Design, Organisation, and Management). By C. H. Wordingham, A.K.C. Second Edition. 24s. net.

ELECTRICITY METERS. By H. G. Solomon. 16s. net.

TRANSFORMERS. By Prof. H. Bohle and Prof. D. Robertson. 21s. net.

ELECTRIC CRANE CONSTRUCTION. By Claude W. Hill, A.M.I.C.E., M.I.E.E. Profusely Illustrated. 25s. net.

ELECTRICAL PHOTOMETRY AND ILLUMINATION. By Prof. H. Bohle, M.I.E.E. Fully Illustrated. 10s. 6d. net.

ELECTRIC SMELTING AND REFINING. By Dr. W. Borchers. Translated by W. G. McMillan, F.I.C. Second Edition. 21s. net.

ELECTRO-METALLURGY. By Walter G. McMillan, F.I.C., F.C.S. Third Edition, Revised and Enlarged by W. R. Cooper. Demy 8vo. 12s. 6d. net.

ELECTRICAL PRACTICE IN COLLIERIES. By Prof. D Burns, M.E. Cloth. Third Edition, Revised. With numerous Illustrations. 7s. 6d. net.

WIRELESS TELEGRAPHY. By Gustav Eichhorn, Ph.D. In Large 8vo. Fully Illustrated. 8s. 6d. net.

TELEGRAPHIC SYSTEMS, and Other Notes. By Arthur Crotch, of the Engineer-in-Chief's Department, G.P.O. Illustrated. 5s. net.

ELECTRICAL RULES AND TABLES (A Pocket-book of). By John Munro and Professor Jamieson. Nineteenth Edition, Revised. Pocket size. Leather. 8s. 6d.

ELECTRICAL THEORY AND THE PROBLEM OF THE UNIVERSE. By G. W. de Tunzelmann. 15s. net.

THE THEORY OF STATISTICS. By G. Udny Yule. Second Edition. 10s. 6d. net.

WORKS BY W. J. MACQUORN RANKINE, LL.D., &c.

CIVIL ENGINEERING (A Manual of). Twenty-Fourth Edition. 16s.

A MANUAL OF APPLIED MECHANICS. With numerous Illustrations. Eighteenth Edition. 12s. 6d.

A MANUAL OF MACHINERY AND MILLWORK. With nearly 300 Illustrations. Seventh Edition. By W. J. Macquorn Rankine, LL.D. 12s. 6d.

A MANUAL OF THE STEAM ENGINE AND OTHER PRIME MOVERS. Seventeenth Edition. By W. J. Macquorn Rankine, LL.D. 12s. 6d.

A MECHANICAL TEXT-BOOK: A Simple Introduction to the Study of Mechanics. By Prof. Rankine and C. E. Bamber. Fifth Edition. 9s.

USEFUL RULES AND TABLES: For Architects, Builders, Engineers, Founders, Mechanics, Shipbuilders, Surveyors, &c. Eighth Edition. 10s. 6d.

WORKS BY PROF. A. JAMIESON, M.Inst.C.E.

STEAM AND STEAM ENGINES (Advanced). Seventeenth Edition. 10s. 6d.

APPLIED MECHANICS AND MECHANICAL ENGINEERING. Vol. I.—Applied Mechanics, 6s. II.—Strength of Materials, 5s. III.—Theory of Structures, 5s. IV.—Hydraulics, 5s. V.—Theory of Machines. 7s. 6d.

HEAT ENGINES: STEAM, GAS, AND OIL (Elementary Manual of). Thirteenth Edition, Revised and Enlarged. 3s. 6d.

MAGNETISM AND ELECTRICITY (Practical Elementary Manual of). Eighth Edition, Revised and Enlarged. 3s. 6d.

APPLIED MECHANICS (Elementary Manual of). Ninth Edition, Revised and Greatly Enlarged. 3s. 6d.

GRIFFIN'S BOOKS ON
MARINE ENGINEERING AND NAVAL ARCHITECTURE.

A MANUAL OF MARINE ENGINEERING. By A. E. SEATON, M.Inst.C.E., M.I.Mech.E., M.Inst.N.A. SEVENTEENTH EDITION, Thoroughly Revised Throughout. Largely Re-set. Very greatly Enlarged. (Nearly 1,000 Pages.) 28s. net.

THE THEORY OF THE STEAM TURBINE. By ALEXANDER JUDE. SECOND EDITION, 18s. net.

GRIFFIN'S NEW GUIDE TO THE BOARD OF TRADE EXAMINATIONS FOR MARINE ENGINEERS. Vol. I.—Calculations for Marine Engineers, including all the Arithmetic for 1st and 2nd Class Engineers' Certificates. 8s. 6d. Vol. II.—Elementaries, Verbals, and Drawing. At Press.

THERMO-DYNAMIC PRINCIPLES OF ENGINE DESIGN. By L. M. HOBBS, R.N. 4s. 6d. net.

ENGINE-ROOM PRACTICE. By JOHN G. LIVERSIDGE, R.N. SEVENTH EDITION, Revised and Enlarged. 6s. net.

SEA WATER DISTILLATION. By FRANK NORMANDY. In Handsome Cloth. Fully Illustrated. 6s. net.

MARINE ENGINEERING RULES AND TABLES. By A. E. SEATON and H. M. ROUNTHWAITE. ELEVENTH EDITION, Thoroughly Revised. Pocket Size. 8s. 6d.

THE SCREW PROPELLER, and Other Competing Instruments of Marine Propulsion. By A. E. SEATON, M.Inst.C.E. Fully Illustrated. 12s. 6d. net.

THE DESIGN AND CONSTRUCTION OF SHIPS. By Prof. J. H. BILES, LL.D., &c. Vol. I.—Calculations and Strength. With 36 Folding Plates and 245 other Illustrations. Complete in itself, with Index. 25s. net. Vol. II.—Stability, Resistance, Propulsion, and Oscillations. Complete with Index. 25s. net.

STEEL SHIPS. Their Construction and Strength. By THOMAS WALTON. FOURTH EDITION, Greatly Enlarged. 18s. net.

PRESENT DAY SHIPBUILDING. For Shipyard Students, Engineers, &c. By THOMAS WALTON. Fully Illustrated. 7s. 6d. net.

THE STABILITY OF SHIPS. By Sir EDWARD J. REED, K.C.B., F.R.S., M.P. In Large 8vo. 25s.

HYDROGRAPHIC SURVEYING. For the Use of Beginners, Amateurs, and Port and Harbour Masters. By Commander S. MESSUM, of the R.N. College, Greenwich. 12s. net.

SEE ALSO PREVIOUS TWO PAGES.

GRIFFIN'S NAUTICAL SERIES.

Elementary Seamanship. By D. WILSON-BARKER. 5th Ed. 6s.

Know Your Own Ship. By T. WALTON. 12th Ed. 7s. 6d.

Trigonometry. By R. C. BUCK. 3rd Ed. 3s. 6d.

Practical Algebra. By R. C. BUCK. 2nd Ed. 3s. 6d.

Practical Mechanics. By T. MACKENZIE. 3rd Ed. 3s. 6d.

Navigation: Theoretical and Practical. By D. WILSON-BARKER and W. ALLINGHAM. 2nd Ed. 3s. 6d.

Marine Meteorology. By W. ALLINGHAM. 7s. 6d.

Latitude and Longitude. By W. J. MILLAR. 2nd Ed. 2s.

The Legal Duties of Shipmasters. By B. W. GINSBURG. 3rd. Ed. 5s.

A Medical and Surgical Help for Shipmasters. By W. JOHNSON SMITH. 4th Ed. 5s. net.

English-Spanish & Spanish-English Sea Terms & Phrases. By Fleet-Paymaster GRAHAM-HEWLETT. Pocket Size. 3s. 6d. net.

Definitions in Navigation & Nautical Astronomy. By P. GROVES-SHOWELL, L.C.C. School, Poplar. Illustrated. 2s. 6d. net.

THE PRACTICAL DUTIES OF SHIPMASTERS. By Capt. W. HARRY WILKES. Cloth. 2s. 6d. net.

GRIFFIN'S MINING AND GEOLOGICAL WORKS.

ORE AND STONE MINING. By Sir C. Le Neve Foster, D.Sc., F.R.S. Seventh Edition, Revised by Prof. S. H. Cox, A.R.S.M. 28s. net.

THE ELEMENTS OF MINING AND QUARRYING. By Sir C. Le Neve Foster, D.Sc. Revised by Prof. S. H. Cox. Second Edition. 7s. 6d. net.

METHODS OF AIR ANALYSIS. By J. S. Haldane, M.D., LL.D. In Crown 8vo. 5s. net.

THE AIR OF MINES. By Prof. J. Cadman and J. S. Haldane, M.D., LL.D.

A TEXT-BOOK OF COAL-MINING. By H. W. Hughes, F.G.S. Fifth Edition, Revised and Enlarged. With 4 Plates and 670 Illustrations. 24s. net.

PRACTICAL COAL-MINING. By George L. Kerr, M.E. Fifth Edition, Rewritten.

ELEMENTARY COAL-MINING. By George L. Kerr, M.E. With 200 Illustrations. Third Edition, Revised. 3s. 6d.

ELECTRIC SIGNALLING IN MINES. By Gerald H. Hooghwinkel, M.Inst.E.E.

MINE SURVEYING. For the Use of Managers of Mines and Collieries, &c. By Bennett H. Brough, F.G.S. Thirteenth Edition, Reprinted. 6s. net.

THEODOLITE SURVEYING AND LEVELLING. By Prof. James Park, F.G.S. In Crown 8vo. Cloth. Illustrated. Second Edition. 7s. 6d. net.

THE EFFECTS OF ERRORS IN SURVEYING. By Hy. Briggs. 5s net.

MINING GEOLOGY. A Text-Book for Mining Students and Miners. By James Park, F.G.S., M.Inst.M.M. Third Edition. 6s. net.

PROSPECTING FOR MINERALS. By Prof. S. Herbert Cox. Sixth Edition, Revised. 5s.

MINERALOGY OF THE RARER METALS. By Edward Cahen and W. O. Wootten. Pocket Size. Leather. 6s. net.

MINING LAW OF THE BRITISH EMPIRE. By Charles J. Alford, F.G.S. Cloth. 8s. 6d. net.

MINE ACCOUNTS AND MINING BOOK-KEEPING. By J. G. Lawn, Assoc.R.S.M. Seventh Edition. 10s. 6d.

MODERN MINE VALUATION. By M. H. Burnham, M.Sc. 10s. 6d. net.

THE MINING ENGINEER'S REPORT BOOK AND DIRECTORS' AND SHAREHOLDERS' GUIDE. By Edwin R. Field. Third Edition. Pocket Size. Leather. 3s. 6d

ELECTRICAL PRACTICE IN COLLIERIES. By Prof. D. Burns, M.E., M.Inst.M.E. Third Edition, Revised. 7s. 6d. net.

SHAFT SINKING IN DIFFICULT CASES. By J. Riemer and J. W. Brough. 10s. 6d. net.

BLASTING: And the Use of Explosives. By O. Guttmann. Second Edition. 10s. 6d.

TESTING EXPLOSIVES. By C. E. Bichel and Axel Larsen. With many Plates. 6s. net.

SPANISH AND SPANISH-AMERICAN MINING, METALLURGICAL, AND ALLIED TERMS. By Edward Halse, A.R.S.M. Cloth. 10s. 6d. net.

GETTING GOLD. A Gold-mining Handbook for Practical Men. By J. C. F. Johnson, F.G.S., A.I.M.E. Third Edition. 3s. 6d.

GOLD-SEEKING IN SOUTH AFRICA. A Handbook of Hints. By Theo. Kassner. Illustrated. 4s. 6d.

STRATIGRAPHICAL GEOLOGY AND PALÆONTOLOGY (on the Basis of Phillips). By R. Etheridge, F.R.S. 34s.

AIDS IN PRACTICAL GEOLOGY. By Prof. G. Cole, M.R.I.A. Sixth Edition. 10s. 6d.

GEOLOGY FOR ENGINEERS. By Lieut.-Col. R. F. Sorsbie. Fully Illustrated. 10s. 6d. net.

MINERAL WEALTH AND GEOLOGY OF CHINA. By C. Y. Wang. 3s. net.

GRIFFIN'S METALLURGICAL SERIES.

AN INTRODUCTION TO METALLURGY. By Sir W. C. ROBERTS-AUSTEN, K.C.B., F.R.S., A.R.S.M. SIXTH EDITION, Revised and considerably Enlarged by F. W HARBORD, A.R.S.M. 18s. net.

THE METALLURGY OF GOLD. By T. KIRKE-ROSE, D.SC., Chemist and Assayer to the Royal Mint. FIFTH EDITION, Revised and partly re-written. Illustrated. 21s.

THE METALLURGY OF SILVER. By H. F. COLLINS, Assoc.R.S.M., M.Inst.M.M. Comprising details regarding the Sources and Treatment of Ore, Description of Plants and Processes, and the Cost of Working. SECOND EDITION. *In Preparation.*

THE METALLURGY OF LEAD. An Exhaustive Treatise on the Manufacture of Lead. By H. F. COLLINS, Assoc.R.S.M., M.Inst.M.M. SECOND EDITION, Revised. 21s. net.

THE METALLURGY OF STEEL. By F. W. HARBORD, Assoc.R.S.M., F.I.C., and J. W. HALL, A.M.Inst.C.E. FOURTH EDITION. In two volumes. 36s. net.

THE METALLURGY OF IRON. By THOMAS TURNER, Assoc.R.S.M., F.I.C., Professor of Metallurgy, Birmingham University. THIRD EDITION, Revised and Illustrated. 16s. net.

ALLOYS, AND THEIR INDUSTRIAL APPLICATIONS. By EDWARD F. LAW, A.R.S.M. With Frontispiece in Colours and Beautiful Series of Photo-Micrographs. 12s. 6d. net.

ANTIMONY: Its History, Chemistry, Mineralogy, Geology, Metallurgy, Preparation, &c. By C. Y. WANG. In Large 8vo. Cloth. Illustrated. 12s. 6d. net.

THE METALLURGY OF COPPER. By THOS. C. CLOUD, A.R.S.M. [*In Preparation.*

OTHER METALLURGICAL WORKS.

MODERN COPPER SMELTING, LECTURES ON. By D. M. LEVY. Illustrated. 10s. 6d. net.

CAST IRON IN THE LIGHT OF RECENT RESEARCH. By W. H. HATFIELD, B.Met. Profusely Illustrated. 10s. 6d. net.

CYANIDING GOLD AND SILVER ORES. By H. FORBES JULIAN and EDGAR SMART, A.M.Inst.C.E. SECOND EDITION. 21s. net.

THE CYANIDE PROCESS OF GOLD EXTRACTION. By Prof. JAMES PARK, F.G.S. FOURTH ENGLISH EDITION. 7s. 6d. net.

TEXT-BOOK OF ASSAYING. By J. J. BERINGER, F.I.C., F.C.S., and C. BERINGER, F.C.S. TENTH EDITION. Illustrated. 10s. 6d.

METALLURGICAL ANALYSIS AND ASSAYING. A Three Years Course. By W. A. MACLEOD, B.A., B.Sc., and CHAS. WALKER, F.C.S. 12s. 6d. net.

MICROSCOPIC ANALYSIS OF METALS. By FLORIS OSMOND and J. E. STEAD, F.R.S. Profusely Illustrated. 7s. 6d. net.

METALLIC ALLOYS: Their Structure and Constitution. By G. H. GULLIVER, B.Sc., F.R.S.E. SECOND EDITION, Thoroughly Revised. At Press.

INTRODUCTION TO PRACTICAL METALLURGY. By Prof. THOS. TURNER, A.R.S.M. 3s. net.

ELEMENTARY METALLURGY. By A. HUMBOLDT SEXTON, F.I.C. FOURTH EDITION. Fully Illustrated. 6s.

LECTURES ON IRONFOUNDING. By Prof. T. TURNER. SECOND EDITION. 3s. 6d. net.

GENERAL FOUNDRY PRACTICE. A. McWILLIAM, A.R.S.M., and PERCY LONGMUIR. In Medium 8vo. SECOND EDITION, Revised. 15s. net.

BLAST FURNACE PRACTICE. By J. J. MORGAN, F.C.S. In Crown 8vo. Cloth. 1s. 6d net.

MODERN FOUNDRY PRACTICE. By J. J. MORGAN, F.C.S. 2s. 6d. net.

NOTES ON FOUNDRY PRACTICE. By J. J. MORGAN. 2s. 6d. net.

ELECTRIC SMELTING AND REFINING. By Dr. W. BORCHERS and W. G. McMILLAN. SECOND EDITION. 21s. net.

TREATISE ON ELECTRO-METALLURGY. By W. G. McMILLAN and W. R. COOPER. THIRD EDITION, Revised. 12s. 6d. net.

WORKS ON PETROLEUM.

PETROLEUM AND ITS PRODUCTS. By Sir BOVERTON REDWOOD, D.Sc. SECOND EDITION, Revised. 45s.

A HANDBOOK ON PETROLEUM, for Inspections under the Petroleum Acts. By Capt. J. H. THOMSON and Sir. B. REDWOOD. SECOND EDN., Revised. 8s. 6d. net.

OIL FUEL. Its Supply, Composition, and Application. By S. H. NORTH. SECOND EDITION, Revised and Enlarged by EDWARD BUTLER, M.I.Mech.E. 6s. net.

LABORATORY HANDBOOK OF MINERAL OIL TESTING. By J. A. HICKS. SECOND EDITION, Revised. 2s. 6d. net.

GRIFFIN'S TECHNICAL PUBLICATIONS.

Chemistry for Engineers and Manufacturers. By BERTRAM BLOUNT, F.I.C., and A. G. BLOXAM, F.I.C. Vol. I. SECOND EDITION. 14s. Vol. II. SECOND EDITION. 16s.

Oils, Fats, Butters, and Waxes. By C. R. ALDER WRIGHT, D.Sc. Revised by C. A. MITCHELL, B.A., F.I.C. SECOND EDITION. With 800 pages. 25s. net.

Physico-Chemical Tables. By J. CASTELL-EVANS, F.I.C. Vol. I.—Chemical Engineering. 24s. net. Vol. II.—Physical and Analytical Chemistry. 36s. net.

Water Analysis for Sanitary and Technical Purposes. By H. B. STOCKS, F.I.C., F.C.S. 4s. 6d. net.

Methods of Air Analysis. By J. S. HALDANE, M.D., LL.D., F.R.S. Fully Illustrated. 5s. net.

Foods: Their Composition and Analysis. By A. W. and M. W. BLYTH. SIXTH EDITION. 21s.

Poisons: Their Effects and Detection. By A. W. and M. W. BLYTH. FOURTH EDITION. 21s. net.

Flesh Foods: (Chemical, Microscopical and Bacteriological Examination). By C. A. MITCHELL. 10s. 6d.

Dairy Chemistry. By H. DROOP RICHMOND, F.I.C., Chemist to the Aylesbury Dairy Co. SECOND EDITION.

Dairy Analysis. By H. DROOP RICHMOND, F.I.C. Crown 8vo. Illustrated. 2s. 6d. net.

Milk: Its Production and Uses. By EDWARD F. WILLOUGHBY, M.D. 6s. net.

Elementary Agricultural Chemistry. By HERBERT INGLE, B.Sc. Illustrated. 4s. 6d. net.

The Principles and Practice of Brewing. By Dr. W. J. SYKES. THIRD EDITION, Revised by A. R. LING, F.I.C. 21s. net.

Technical Mycology. Dr. F. LAFAR. SECOND EDITION. In Two Vols. Vol. I., 15s net. Vol. II., 24s. net.

Micro-Organisms and Fermentation. By ALFRED JÖRGENSEN. FOURTH EDITION, Completely Revised. Translated by S. H. DAVIES, B.Sc. 15s. net.

Ferments and Their Actions. By C. OPPENHEIMER. Translated by C. A. MITCHELL, B.A., F.I.C. In Cloth. 7s. 6d. net.

Peat: Its Use and Manufacture. By P. R. BJÖRLING and F. T. GISSING. Illustrated. 6s. net.

Commercial Peat: Its Uses and Its Possibilities. By F. T. GISSING. In Crown 8vo. Cloth. 6s. net.

Paper Technology. By R. W. SINDALL, F.C.S. In Medium 8vo. Handsome Cloth. Illustrated SECOND EDITION. Revised. 12s. 6d. net.

The Clayworkers' Handbook. By A. B. SEARLE. SECOND EDITION, Revised. In Cloth. 6s. net.

British Clays, Shales, and Sands. By A. B. SEARLE. Illustrated. 7s. 6d. net.

Ceramic Literature. Compiled. Classified, and Described. By M. L. SOLON. £2 2s. net.

Art of the Goldsmith and Jeweller. By T. B. WIGLEY. 7s. 6d. net.

Modern Methods of Sewage Purification. By G. BERTRAM KERSHAW. Fully Illustrated. 21s. net.

The Principles of Sewage Treatment. By Prof. DUNBAR of Hamburg. Translated by H. T. CALVERT, M.Sc. 15s. net.

Trades' Waste: Its Treatment and Utilisation. By W. NAYLOR, F.C.S., &c. Illustrated. 21s. net.

Smoke Abatement. By WM. NICHOLSON. With Illustrations. 6s. net.

Calcareous Cements. By G. R. REDGRAVE and CHARLES SPACKMAN, F.C.S. SECOND EDITION. 15s. net.

Handbook for Cement Works' Chemists. By FRANK B. GATEHOUSE, F.C.S. In Handsome Cloth. 5s. net.

Gas Manufacture. By W. J. A. BUTTERFIELD. Vol. I., 7s. 6d. net.; Vol. II., *Shortly.*

Calorific Power of Coal Gas. By J. H. COSTE, F.I.C. 6s. net.

Acetylene. By F. H. LEEDS and W. J. A. BUTTERFIELD. SECOND EDITION, Thoroughly Revised. 8s. 6d. net.

Fire and Explosion Risks. By Dr. VON SCHWARTZ. In Cloth. 16s. net.

Practical Sanitation. By GEO. REID, M.D. With Appendix on Sanitary Law, by HERBERT MANLEY, M.A., Barrister-at-Law. SIXTEENTH EDITION. 6s.

GRIFFIN'S TECHNICAL PUBLICATIONS.

Lessons on Sanitation, By J. W. HARRISON, M.R.San.I. 3s. 6d. net.

Sanitary Engineering. By FRANCIS WOOD, A.M.Inst.C.E., &c. SECOND EDITION. Revised. 8s. 6d. net.

Modern Destructor Practice. By W. F. GOODRICH. Illustrated. 15s. net.

Road Making and Maintenance. By THOS. AITKEN, A.M.Inst.C.E. SECOND EDITION. 21s. net.

Dustless Roads: Tar-Macadam. By J. W. SMITH, City Engineer, Edinburgh. 10s. 6d. net.

Enamelling on Iron and Steel. By JULIUS GRÜNWALD. Cloth. Illustrated. 6s. net.

Enamelling and Tinning. By JULIUS GRÜNWALD. Fully Illustrated. 6s. net.

Treatise on Colour Manufacture. By GEORGE ZERR and Dr. RUBENCAMP. English Edition by Dr. C. MAYER, of Burgdorf. Profusely Illustrated. 30s. net.

Tests for Coal-Tar Colours in Aniline Lakes. By GEORGE ZERR. Translated by Dr. C. MAYER. 10s. 6d. net.

Painting and Decorating. A Complete Practical Manual. By W. J. PEARCE. THIRD EDITION, Revised and Enlarged. 12s. 6d.

Painters' Colours, Oils, and Varnishes. G. H. HURST, F.C.S. FIFTH EDITION, Revised and Enlarged.

Painters' Laboratory Guide. By G. H. HURST, F.C.S. In Cloth. 5s.

The Chemistry of the Colloids. By Dr. V. PÖSCHL. Translated by Dr. H. HODGSON. 3s. 6d. net.

Celluloid: Its Manufacture, Application and Substitutes. From the French of MASSELON, ROBERTS AND CILLARD. By Dr. H. H. HODGSON.

Chemistry of India Rubber. By C. O. WEBER, Ph.D. THIRD IMPRESSION. With many Illustrations. 16s. net.

The Manufacture of Rubber Goods. By ADOLF HEIL and Dr. W. ESCH. Translated by E. W. LEWIS, A.C.G.I. In Cloth. Illustrated. 10s. 6d. net.

Glue, Gelatine, and Their Allied Products. By THOMAS LAMBERT. In Large Crown 8vo. Fully Illustrated. 5s. net.

Leather Trades Chemistry. By S. R. TROTMAN, M.A., F.I.C. In Handsome Cloth. Fully Illustrated. 15s. net.

Ink Manufacture. By C. A. MITCHELL, B.A., F.I.C., and T. C. HEPWORTH. In Cloth. With Plates and Illustrations. 7s. 6d. net.

A Manual of Dyeing. By E. KNECHT, Ph.D., CHR. RAWSON, F.I.C., and R. LOEWENTHAL, Ph.D. SECOND EDITION, Thoroughly Revised and Re-written. 45s.

Synthetic Dyestuffs, and the Intermediate Products from which they are Derived. By J. C. CAIN, D.Sc., and J. F. THORPE, Ph.D. In Large 8vo. Cloth. Pp. i.-xv. + 405. 16s. net.

Dictionary of Dyes, Mordants, and Other Compounds. By CHR. RAWSON, F.I.C., W. M. GARDNER, F.C.S., and W. F. LAYCOCK, Ph.D. In Large 8vo. Cloth, Library Style. 16s. net.

Spinning and Twisting of Long Vegetable Fibres (Flax, Hemp, Jute, Tow, and Ramie). By H. R. CARTER. With Plates and Illustrations in the Text. 16s. net.

The Cotton Weavers' Handbook. By H. B. HEYLIN. In Cloth. Fully Illustrated 6s. net.

Textile Fibres of Commerce (Occurrence, Distribution, Preparation, and Uses). By W. I. HANNAN. In Cloth. With Illustrations. 9s. net.

Bleaching and Finishing of Cotton. By S. R. TROTMAN, M.A., and E. L. THORP, M.I.Mech.E. 16s. net.

Textile Printing. By E. KNECHT, Ph.D., and J. B. FOTHERGILL. 36s. net.

Textile Printing. By C. F. S. ROTHWELL, F.C.S. With Illustrations. 21s.

Dyeing and Cleaning. By FRANK J. FARRELL, M.Sc. In Cloth. With 76 Illustrations. THIRD EDITION, Enlarged. 5s. net.

Bleaching and Calico Printing. By GEORGE DUERR, Assisted by WM. TURNBULL Cloth. 12s. 6d.

Inorganic Chemistry. By A. DUPRÉ and WILSON HAKE. THIRD EDITION. 6s. net.

Elements of Chemical Engineering. By J. GROSSMANN, Ph.D. Cloth. 3s. 6d. net.

Outlines of Quantitative Analysis. By A. H. SEXTON, F.I.C. FIFTH EDITION. 3s.

Outlines of Qualitative Analysis. By A. H. SEXTON, F.I.C. FOURTH EDITION. 3s. 6d.

1868

THE LIBRARY
OF
THE UNIVERSITY
OF CALIFORNIA
LOS ANGELES

GIFT OF

COMMODORE BYRON MCCANDLESS

UC SOUTHERN REGIONAL LIBRARY FACILITY

A 000 090 830 1